

Bombay Natural History Society



**Sálim Ali Centenary Seminar
on
Conservation of Avifauna
of
Wetlands and Grasslands**

**February 12-15, 1996
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Abstracts

Monday, 12 February, 1996

Technical Session I

CONSERVATION OF CRANES

1. STATUS OF CRANES WORLDWIDE

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2. THE CURRENT STATUS OF THREE
SPECIES OF CRANES IN IRAN

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Out of the 15 species of Cranes reported worldwide, three species are reported from Iran. They are Common Crane *Grus grus*, Siberian Crane *Grus leucogeranus* and Demoiselle Crane *Anthropoides virgo*. Cranes are found mainly in the north east, north west, west and south western regions of Iran. The Common Crane has two populations in Iran, a wintering population and a very small breeding population. Average wintering population is about 7000 individuals and two breeding pairs were found in 1993, at Gori Gol in north western Iran, North west of Lake Uromiyeh, near the Turkish border

Siberian Crane population was discovered in 1978 and their numbers fluctuated between 4-14 during 17 years of observations. The wintering population of Demoiselle Crane is not clear, only a few cranes have been counted during some mid-winter counts in Iran. A population of about 100 Demoiselle cranes, were discovered on their spring migration. They migrate to north western Iran in the first week of spring and depart the country about mid spring.

3. ECOLOGY OF THE SIBERIAN CRANE IN KEOLADEO NATIONAL PARK,
BHARATPUR, INDIA, DURING THE WINTER OF 1992-93

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The Siberian crane *Grus leucogeranus*, one of the most endangered cranes of the world, had been wintering regularly in the Keoladeo National Park (KNP) during this century till 1993. It is believed to have two populations: (1) about 2000, breeding in eastern Siberia and wintering in

China and (2) about 20, breeding in western Siberia and wintering in India and Iran. The population wintering in India had been declining in the second half of this century from 200 (?) at the beginning of this century to 5 in 1993 and nil thereafter. A decade-long study (1981-1990), Vijayan (1992) on the Ecology of this park brought out the salient features of this ecosystem and the major management problems and probable solutions. As a continuation of this, a monitoring programme was taken up during 1992-93 which included the ecology of the Siberian crane. Only 5 of these arrived in January 1993, a much later date than usual. They occupied some of their traditional areas along the border of the wetland having 10 to 30 cm of water with a vegetation of sedges, grasses and lilies. They spent about 66% of daylight hours for feeding during January which was similar to that in 1986, a well-flooded year. During February - March it was only 59% since they spend more time in flight maintenance activity, prior to leaving the wintering ground on 3 March 1993.

Realising the need for augmenting the population for its conservation, captive rearing and release programmes were initiated in 1991 in Russia. This was extended to India through an international collaboration whereby two captive bred Siberian cranes from Russia were released in KNP in February 1993. One of them behaved normally devoting 50 to 60% of the time to feeding activities, while the other rested on the dyke for most of the time. They did not mingle with the wild flock and stayed behind instead of flying with them to the breeding grounds. Several programmes are being pursued by the Govt. of India in collaboration with other international agencies to re-establish the wintering population of this magnificent crane in India.

4. DISTRIBUTION AND HABITAT UTILIZATION BY CAPTIVE REARED SIBERIAN CRANE *Grus leucogeranus* IN KEOLADEO NATIONAL PARK, BHARATPUR

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Siberian crane *Grus leucogeranus*, breed in Siberia and are winter migrants in India and Iran. Due to the decline of their central population, the species has stopped coming to Keoladeo National Park, since 1992-93. To augment the wild population, captive reared Siberian cranes were released in the park. A study of their distribution in and around the park and habitat utilization was carried out. It revealed that the area was utilised by the captive reared Siberian cranes throughout the year. Occasionally they flew out of the park to spend some time in the surrounding areas. The birds showed adaptation and a change in their feeding habits was noted as compared to their wild counterparts.

5. DEMOISELLE CRANES IN WESTERN RAJASTHAN

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The migratory Demoiselle Crane *Anthropoides virgo* is a permanent resident of North Africa, Central Asia, Persia, South Europe and China. The cranes are winter migrants to India. In Rajasthan, they are common around Jodhpur, Bikaner, Churu and Phalodi. They are locally called "Kurja". The

observations are mainly from village Guda Bishnoiyan, district Jodhpur. The study carried out during the years 1988 to 1994, indicate that the birds do not arrive at the same time, but their population builds up gradually by the third or fourth week of September.

The birds start arriving at the pond site around 9.30 A.M. in groups of 8 - 15, their numbers reaching a peak by 11.30 A.M. At about 4.00 p.m. the birds were observed standing around the pond and were noticed feeding on the seeds of "Motha" sedge *Cyperus rotundus*. They spend the nights around the water body and fly off for foraging on the standing crops, to the nearby fields around 6.00-6.15 a.m.

The area supports a good population of black bucks *Antelope cervicapra*. A small pack of wolves, a fair number of jackals, blue bulls, jungle cats, and fox also inhabit the area, but no predation has been observed amongst the demoiselle cranes. The cranes live in harmony with the antilopes, but maintain a safe distance. The Bishnoi dominated Guda Bishnoiyan is a closed area and the wildlife is well protected.

6. WINTERING COMMON CRANES *Grus grus* AND THEIR HABITAT IN KUTCH, GUJARAT, INDIA

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Distribution, food and feeding behaviour and adult-juvenile ratio of the Common Crane *Grus grus* in Banni grassland, Kutch, were studied from 1992 to 1994. The Banni grasslands are some of the main wintering grounds of the Common cranes in Gujarat. Nearly 30 important wintering sites of the Common Cranes were found. Tubers of sedges *Cyperus* were the main food of the Cranes. Soon after arrival in their wintering grounds, the Cranes dig the soil for tubers. Average number of tubers per 50 x 50 cm quadrat was 51 in foraged areas (n=150) and 58 in unforaged areas (n = 150). Hence only a small percentage of tubers were eaten by the cranes. Digging by cranes benefit doves, larks and sandgrouse which were observed feeding on the exposed tubers. Common Cranes feed during morning and evening and roost in fresh water reservoirs and river beds during afternoon and night. We estimate that nearly 40,000 Common Cranes winter in Banni grasslands and about 75,000 in Kutch district. Banni grasslands are undergoing rapid habitat changes due to spread of an exotic plant *Prosopis juliflora*, therefore the future of Common Crane appears to be uncertain.

7. HABITAT UTILISATION BY SARUS CRANE AND IMPORTANCE OF MAN MADE WETLANDS IN ITS CONSERVATION

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Habitat preference and utilisation studies are extremely important for conservation of a species. Any alteration or degradation of the habitat may adversely affect its population. Habitat utilisation by Sarus Crane and its dependence on man made wetlands was studied in the vicinity of Kota in south east Rajasthan during 1993 and 1994. In the times gone by Chambal river and many of its tributaries were perennial sources of water. Run-off water harvesting systems were prevalent and patronised by the local population. The rivers now flow only seasonally and natural lakes and ponds have become defunct. These have been replaced by man made earthen or masonry tanks, dams, canals, seepage marshes and inundated fields. Sarus Cranes utilise these wetlands for foraging, roosting and breeding. Inundated, cultivated or fallow fields are the most common foraging sites (55.9%), followed by seepage marshes (21.6%), tanks (10%), dams (7.5%), and canals (5%). Drying dam sites and canal beds are mainly used during summer months.

Nesting is most prevalent in seepage marshes formed by the right main canal (76%), followed by inundated fields (14%) and only on two occasions (10%) nests were seen on the margin of the tank. Shallow seepage marshes and inundated fields were most common roosting sites. The observations suggest that Sarus cranes mostly roost in pairs or family parties of 3-7 individuals. Flocking of over 70 birds was only seen near right main canal and in a submerged field on the outskirts of Kota city.

The relative importance of dams, canals and tanks cannot be discounted because during the summer Sarus are found concentrated on these sites. Draining of marshes and fields for cultivation and habitation, commercial exploitation of Typha reeds, wasteful use of stored water and expanding network of power lines are certain immediate threats to the survival of the species in the study area.

8. CRANE CONSERVATION IN INDIA: NEED TO RESHAPE THE WHOLE EFFORT

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The situation for conservation of cranes in India is alarming to say the least ! The effort lacks planning, scientific direction and thrust of implementation. Of the two endangered crane species in India, we already have lost one and the other is grossly neglected. Efforts to rehabilitate Siberian crane lack direction and scientific monitoring. When conservation efforts at the local level are organized for the Blacknecked crane, they receive neither recognition nor official support. People and NGO participation in crane research and conservation is neither encouraged nor supported.

Serious efforts need to be made to conserve the feeding and breeding habitats of all cranes occurring in India. This is necessary from Ladakh in the north to Saurashtra in the west and Arunachal

in the east. A long-term plan of research and conservation, based on cooperation of people and NGOs is urgently required. The concept of Peoples' Sanctuary should be officially recognized and encouraged with suitable incentives.

9. STATUS & CONSERVATION OF THE CRANES IN NORTH-EAST INDIA

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Five species of cranes have been recorded in north-eastern India, these are the Common Crane *Grus grus*, Black-necked Crane *G. nigricollis*, Hooded Crane *G. monacha*, Sarus Crane *G. antigone*, and the Demoiselle Crane *Anthropoides virgo*. All the species are extremely rare or recorded as winter vagrants in the area. This paper discusses the current status and recent sight records of these species.

Recent field studies have confirmed the Common crane as a regular winter visitor. A new migration route of the species through the Dibang Valley of Arunachal Pradesh was discovered in 1993. The Black-necked crane has been recorded in North Bengal and in some small valleys of Arunachal Pradesh, though it seems to have vanished from the Apa Tani Valley, a known wintering site.

The Hooded crane has not been recorded for nearly a century while the Sarus, for nearly half a century except for one stray record of the nominate race, *G. antigone antigone*. This record of 1994 has extended its range by about 500 km. The Burmese or the Indo-Chinese race *sharpii* is virtually extinct in the region. The Demoiselle crane also continues to be an occasional winter visitor with only a few records.

The cranes wintering in protected areas like Orang and Dibru Saikhowa Sanctuaries are safe from any disturbances, unlike other areas where they are often hunted.

POSTER

10. CRANES AND MEN, LIVING TOGETHER

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Cranes are the most endangered family of birds. Hunting, egg collecting and destruction of wetland and grassland habitats have been catastrophic events for cranes worldwide. But in some regions, cranes thrive in response to care provided by people.

Northwest India, with thousands of resident Sarus cranes and tens of thousands of migrant Eurasian and Demoiselle cranes, is an excellent example of coexistence. Sarus cranes are protected

by Hindu tradition; village ponds over much of Rajasthan, Gujarat and Uttar Pradesh often have resident pairs. Their survival, in one of earth's most populous areas, is a tribute to Indians and the cranes ability to adapt to altered environments. A similar public sentiment, in Tibet and Mongolia, ensures the protection of the Black-necked and Demoiselle cranes, in those areas.

Cranes can only survive if human values embrace crane conservation as the Hindus, Tibetans and Mongolians have practised since time immemorial. Public education is vital, alongwith the successful application of new techniques for the reintroduction of Cranes in regions from which they have disappeared.

POSTER

11. SARUS CRANE POPULATION DECLINE : A RESULT OF CONFLICT WITH HUMAN INTERESTS

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The Indian Sarus Crane *Grus antigone*, occurs in very low density in certain irrigated paddy growing areas of Kheda district, Gujarat. Adult bird identity determined during breeding season in September 1989 and 1995 indicates that its density has declined from 0.370 to 0.314 bird per square kilometer. This reduction of c. 15.13% in population density in the crane's most favourite area is alarming. Out of total 107 adults counted during road counts, only 12 pairs (21.49%) were found with eggs or chicks, twenty pairs (37.4%) were potential breeders without nest. Such a large number of non-breeding pairs is another alarming feature. A very high rate of reproductive failure was inferred from adult:juvenile ratio (range 0.09 to 0.23) determined each year since 1989. Out of 21 nests located during two years, 11 were located in paddy fields and 10 in marshy areas. While making the nests in paddy fields, the nesting pair uproots freshly transplanted paddy plants from 10-50 sq. mts. The additional damage to the crop by trampling and feeding leads to a conflict with the farmer. This conflict seems to be a major factor behind their population decline in this area. Strategy for conservation measures is discussed.

Tuesday, 13 February 1996

Technical Session II

CONSERVATION OF DUCKS AND GEESE

12. CENTRAL-ASIAN - INDIAN FLYWAY: EXTENT OF STUDIES, PROBLEMS OF PROTECTION, NECESSITY OF INTERNATIONAL CO-OPERATION

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Central Asian - Indian (or Central-Siberian - Indian) Flyway within Russian limits, is situated mostly in the Yenisey River basin - i.e. in the Krasnoyarsk Territory, which comprises more than 10% of the Russian Federation and partly in the adjacent areas of Yakutia and Western Siberia. This is one of the most important flyways of the entire Eurasian Supercontinent. However, it is poorly studied as compared with the other Eurasian flyways of the Western Palearctic. Cooperative field studies and conservation programmes for avifauna, between Russia, India and other countries are practically absent. The Convention on Migratory Birds Protection between the USSR and India has become redundant.

According to an estimate for the Krasnoyarsk Territory in 1980 - 1985, the waterfowl numbers in the post-breeding period were about 10.5 million birds (Syroechkovski Rogacheva, 1980; Martynov, 1983; 1992 a.o.). The most numerous among the anatidae were; *Anas crecca* (1-300 thousand), *Clangula hyemalis* (1-600 ths.), *Anas acuta* (920 ths.), *Bucephala clangula* (690 ths.), *Anas penelope* (640 ths.), *Aythya marila* (530 ths.), *Aythya fuligula* (440 ths.), *Anas platyrhynchos* (490 ths.), *Mergus merganser* (270 ths.), *Mergus serrator* (200 ths.), *Anas querquedula* (185 ths.), *Mergus albellus* and *Anas clypeata* (100 ths.). Amongst geese, Bean Goose and Whitefronted Goose were most numerous (about 500 ths. each). Waders and gulls were not enumerated. Duck ringing in the Yenisey basin is still poorly developed, though hunters from the Krasnoyarsk Territory often kill ducks mostly Wigeons and teals with BNHS rings.

According to the estimates of E.V. Rogacheva (1992), the total population of ducks and geese in the middle reaches of the Yenisey River decreased four times during sixty years (1930-1990). Waterfowl migration in the area has been studied since 1958 (Syroechkovski Rogacheva, 1994). A conservation programme for wetlands as habitats of waterfowl in the Yenisey region was initiated about three decades earlier (S.Rogacheva, 1965), which has been partly successful, though the programme to create a chain of protected wetlands, along the entire flyway, ie. from the Arctic tundras of Taimyr up to India, remains unaccomplished.

A comparative ecological study of wetlands along the giant Asian Ecological Transect, is of special interest. The transect envelops the entire biodiversity of nature zones of Asia, beginning from the Arctic upto the tropics. This study can succeed only through the joint efforts of Russia and India, in co-operation with other countries of the region.

13. REMOTE SENSING/GIS APPLICATIONS IN AVIAN HABITAT CONSERVATION

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The paper deals with the application of modern spatial technologies to avian habitat conservation in India. In particular, the use of satellite remote sensing and Geographic Information System to help locate habitats of pheasants and delienation, description of new habitats for avian conservation are highlighted.

A brief description of satellite sensors, their spatial and spectral resolutions vis-a-vis avian habitat requirements is given. Problems and prospects of habitat identification through visual and digital analyses are discussed. The potential of Geographic Information System as well as the Global Positioning Systems are described. Specific case studies of pheasant conservation in Himalayas and wetland habitat delienation are presented. The need for adoption of these technologies by the conservation community is emphasised in the context of mounting anthropogenic pressures on the remaining habitats.

14. CONSERVATION AND MANAGEMENT ASPECTS OF SOME ANATIDAE SPECIES IN BANGLADESH

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Bangladesh is an important country for the longterm survival of winter migrants, especially Anatidae, because wetland ecosystems dominate the country's landscape. Ducks and geese are amongst those group of wildlife, which are culturally interlinked with a vast majority of the people living in or adjacent to these ecosystems.

35 species of Anatidae have been recorded in Bangladesh, of which six are resident, viz. *Dendrocygna javanica*, *Dendrocygna bicolor*, *Sarkidiornis melanotos*, *Cairina scutulata*, *Nettapus coromandelianus*, *Anas poecilorhynca*, while the rest are migratory. The country, with its vast network of coastal and inland wetlands, is an important staging and wintering ground in the South East Asian/ Australasian Flyways, for at least ten species of threatened Anatidae. This paper discusses the movement pattern of the winter migrants in these flyways, based on five years of field monitoring at ten key wetland sites. Habitat preference and distribution of some threatened Anatidae populations, viz. *Anser indicus*, *Anser anser*, *Aythya baeri*, *Aythya marila*, *Sarkidiornis melanotos*, *Cairina scutulata* and the trapping/harvesting pressure to which they are exposed are also discussed. The paper highlights the conservation and management issues and recommends an effective networking key for the region.

15. ASIA-PACIFIC MIGRATORY WATERBIRD CONSERVATION STRATEGY 1996- 2000: AN INTERNATIONAL FRAMEWORK FOR WATERBIRD AND HABITAT CONSERVATION

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In December 1994, an international workshop was held in Japan to discuss priorities for the conservation of migratory waterbirds and their wetland habitats in the East Asian-Australasian Flyway. Technical outcomes of the workshop were summarized in the "Kushiro Initiative" and one important recommendation was to implement a framework to guide conservation efforts of migratory waterbirds in the Asia-Pacific region.

In response to this call, an "Asia-Pacific Migratory Waterbird Conservation Strategy 1996-2000" has been developed by Wetlands International (formerly Asian Wetland Bureau) and International Waterfowl and Wetlands Research Bureau - Japan Committee. During 1995, the *Strategy* has been presented at a number of international fora where it has gained interest and support from governments and NGOs alike.

The *strategy* covers seven broad themes. Conservation of species; Conservation of Habitats; Research and Monitoring; Education; Information and Awareness; Training; Policy and Legislation. It outlines several priorities, actions needed, notably development and implementation of: action plans for species groups; networks of sites of importance for species; reviews of legislation and policy; training; public information and awareness programmes and the development of an international waterbird agreement.

The paper will outline the *strategy* and provide a broad overview of the range of action-points that are being initiated.

16. SPATIAL USE PATTERN OF WATERFOWL IN KEOLADEO NATIONAL PARK, BHARATPUR, INDIA

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Waterfowl are one of the most diversified groups of wetland birds. Several species of waterfowl congregate in wintering habitats in large numbers which often exceed several thousands. However, the mechanism of their coexistence is poorly known. The present paper attempts to analyse the spatial resource partition by waterfowl. The study was conducted in Keoladeo National Park, during the winters of 1987-88 and 1988-89. Direct observations were made from sunrise to sunset for data collection on the usage of habitat and feeding methods by waterfowl. Habitats were categorised based on vegetation and water depth. Feeding methods of waterfowl were recognised based on the feeding posture adopted. In some species their biometry was used to find out the water column (vertical) use pattern.

Seven habitat types and eight feeding methods were used by waterfowl in KNP during the present study. Habitat and water depth preference of common waterfowl species are discussed. Water depth use at horizontal and vertical levels by individual species are given. Adaptability to use a variety of habitats (niche breadth) and overlap in the use of resources among waterfowl are also discussed.

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17. EVALUATING THE HABITAT SUITABILITY INDEX (HSI) MODEL AS APPLIED TO THE WHITE WINGED WOOD DUCK *CAIRINA SCUTULATA* IN ASSAM

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The White Winged Wood Duck *Cairina scutulata* inhabits the wetland habitats in tropical evergreen, semi-evergreen and moist deciduous forests of Assam. Major distribution range of the species is within eastern Assam, mainly in Dibrugarh and Tinsukia districts and in the Sonitpur district of central Assam, situated in the foothills of Arunachal Pradesh. Two distinct White Winged Wood Duck (WWWD) populations have been identified in Assam, one in the central part of northern Assam having moist deciduous and semi-evergreen forests in Bhabar tract and the other in eastern Assam having moist deciduous, evergreen and semi-evergreen forests in alluvial floodplains.

The studies have been carried out to assess the current usage of available habitat by WWWD in Assam vis-a-vis the Remedial Action Plan (RAP). A review and synthesis of relevant information generated during last four years was used to develop a HSI model for the WWWD in Assam. The habitat utilization data have been consolidated to produce an index between 0.0 (unsuitable habitat) and 1.0 (optimal suitable habitat). In the present study, the Doomdooma Reserved Forest constitutes the highest HSI, followed closely by Nameri Wildlife Sanctuary.

Survival of the species is dependent to a large extent on the micro-manipulation of the habitat. The HSI model will ultimately guide the management practice through RAP, in a situation where mega protection approach is not enough for enhancement of the population. Steps have already been initiated for accurate monitoring of habitat changes for longterm conservation measures.

18. CONSERVATION OF THE WHITE-WINGED WOOD DUCK IN INDIA

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The White-winged wood duck *Cairina scutulata*, is among the most threatened and poorly studied ducks of the world. This paper is based on a decade-long field study carried out in different parts of North-eastern India including a detailed survey in parts of Upper Assam and Arunachal Pradesh in 1992-94.

In India, the species is found mostly in Assam and Arunachal Pradesh with small numbers in other north-eastern states. It is a bird of the tropical rain forest, their density is higher on flat and low undulating terrain. The study revealed that a viable population still survives in eastern Assam and adjacent areas of Arunachal Pradesh. Scattered populations occur in some other pockets.

Five nesting sites were examined and at least another 25 sites were identified. Average clutch and brood size were 5.40 and 5.89 respectively. Ground nesting has been recorded for the first time. It was noted that some birds remain active during daytime also, especially in less disturbed areas.

Habitat destruction, hunting, traditional trapping, collection of eggs and ducklings, pollution of waterbodies by oil and tea industries are the major conservation problems. Potential sites have been identified and recommended for conservation. Upper Dihing (west block) reserved forest and adjacent areas of eastern Assam are important for the conservation of the species and have been recommended for a National park.

19. ILLEGAL TRADE OF WATER BIRDS IN NORTHERN INDIA

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Man has been a foodgatherer since time immemorial, hunting being a major tool which enhanced his efforts. This was later replaced by farming as the prime source. Waterbirds have been a source of food and hence harvested by many people in India. However, due to indiscriminate trapping, the populations of many species have declined alarmingly. Therefore, the Government of India, imposed a total ban on the trade of wild birds in 1991.

A survey done by TRAFFIC-INDIA, from 1993 onwards, revealed that certain communities like Mir Shikars, Baheliya, Pathani, Chirimar, Sahanis and Munda, are still dependent on waterbird trapping as a livelihood. Nearly 456 waterbirds of 34 species were recorded in just four bird markets of Lucknow, Kanpur and Unnao in Uttar Pradesh. This indicates the intensity of the trade in Northern India. We estimate that the trade involves thousands of waterbirds in a single season. Interviews with bird trappers in the towns mentioned above, revealed that most of the birds sold in weekly markets were from nearby wetlands such as Nawabganj jheel, Kurri and Bachrawa.

With the growing concern for wildlife conservation and the rapid destruction and alteration of habitat, there is an urgent need to study the damage caused by the once traditional trapping of birds. This activity is now highly commercialised. Use of poison for baiting waterbirds for mass captures, extensive trapping of ducks, collection of chicks of some species such as Sarus crane *Grus antigone*, etc. is a cause for concern.

Most of the traditional bird trappers are aware of the illegality of their trade and are willing to change their profession, if alternate employment opportunities are provided. Besides strict enforcement of the Wildlife Protection Act, the problem has to be considered humanely. Professional trappers, most of them very experienced in keeping birds, should be employed in zoos, field research projects and bird sanctuaries.

20. ECOLOGY OF THE DUCKS AND GEESE (ANATIDAE) IN CHILIKA LAKE, ORISSA, INDIA

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Chilika Lake in Orissa is one of the Ramsar sites and is the largest brackish water wetland in the country. The lake abounds in diverse aquatic flora and fauna and attracts migratory birds, mainly ducks and geese. Anatidae population is the maximum (72%), while the rest (28%) comprise other aquatic birds such as waders, storks and grebes.

During the study period spread over several seasons, the atmospheric temperature ranged between 18°C - 40°C, relative humidity was 43% - 98%, salinity ranged between 0.1 PPT (Aug.-Sept.) to 19.0 PPT (May) and 22 PPT (mouth of the lake). The average annual rainfall was 1100 mm.

Among the habitat types categorised, shallow clear water with submerged weed was the most preferred habitat for feeding followed by deep water with submerged weed, prawn cultivation pen, grassy land (mainly geese) and rocky land. Majority of the aquatic birds were seen feeding between 0600-1200 hrs. and 1400-1800 hrs., whereas the period between 1200-1400 hrs were utilised for roosting. Major food items of the ducks include weed *Potamogeton pectinatus*, *Halophila ovata* and the associated algal species.

This study emphasizes that the ecological inter-relationship between the migratory birds and the physico-chemical properties of water, floral and faunal composition and biotic interference, need to be studied in detail.

POSTER

21. WATERFOWL POPULATIONS AROUND BARODA

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Wetlands are crucial to our environment as they have high concentration of nutrients and thus high primary productivity. Although wetlands comprise a rich and dynamic ecosystem, except for a few larger ones, the majority are totally neglected.

In the present study ten wetlands in Baroda district were surveyed for their waterfowl populations in February 1995. These were divided into two groups of five each, Group I - Village/Temple pond and Group II-Irrigation dams. A total of 7181 waterfowl of 51 species, including 19 winter migrants and 15 resident species known to breed in and around Baroda were recorded.

No significant differences were noted in the two groups when mean Species richness (I - 19.8 ± 6.9 , II - 21.6 ± 8.29), mean diversity H' - I - 2.08 ± 0.42 , II - 1.85 ± 0.286) and mean equitability (I - 0.707 ± 0.103 , II - 0.616 ± 0.112) were compared. It was noted that deviation from mean was more in diversity values of group I which faces some disturbances from villagers or pilgrims. 1994 being a good monsoon year, birds were widely distributed. This will be compared to a lean period when drought is expected. This study reveals that:

- 1) Though no significant differences were noted in the mean species diversity in the two groups, group II had higher species richness with higher diversity, compared to the other group, indicating disturbances due to human activities.
- 2) These smaller wetlands should be studied thoroughly and protection measures enhanced.

Tuesday, 13 February, 1996

Technical Session III

CONSERVATION OF BUSTARDS AND FLORICANS

**22. RECENT DEVELOPMENTS IN A CONSERVATION MANAGEMENT
STRATEGY FOR THE HOUBARA BUSTARD *Chlamydotis undulata***

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The Houbara Bustard is a very shy desert bird with a wide but sparse breeding range from north-west Africa through to China. Small numbers still breed in Arabia, but larger numbers migrate to the region from their breeding grounds in Iran and the southern republics of the former USSR. While the overall Central Asian population is estimated to exceed 1,00,000 birds, numbers have declined greatly over recent decades for a variety of reasons which include hunting, agricultural intensification and other land use changes.

The Houbara Bustard is the traditional quarry of Arab falconers. The origin of the considerable skills involved in hunting houbara with falcons goes back many centuries, when the species served as an important source of protein for the nomadic people. Falconry was one of the key skills required for life in the desert and tribal leaders were invariably masters of the tradition. As a consequence, falconry is an important element of the cultural heritage and represents a tangible link with the early lifestyles of indigenous people in the Gulf region. With increasing wealth and the development of modern transport and communications, however, the efficiency of hunting has been transformed and much of the hunting is now carried out in other countries, much to the alarm of conservationists worldwide.

This paper traces the history of attempts by conservationists to tackle the problem, from the mid-1960s to the present day. The study shows how increasing ecological information about the bird and its habitats, international legal developments (in particular CITES and the Bonn Convention on Migratory Species) and establishing a dialogue with the main parties is bringing about a change in attitudes. The houbara bustard now seems to be emerging as another example of deriving conservation benefits from wise use of wild steppic birds such as ostriches and quails.

**23. POPULATION DYNAMICS OF THE GREAT BUSTARD IN STEPPES
EAST OF THE MIDDLE VOLGA RIVER**

VALERY N. MOSEIKIN AND ANATOLY V. KHRUSTOV

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Russia.

At the beginning of the 20th century the Great Bustards were common along the Volga river. Major part of their populations were concentrated within the Steppe area which presently comprises

the Saratov region. The Great Bustard populations at that time were estimated at 20-40 thousand individuals. Their population had increased to 50-60 thousand individuals by the end of the 1950's. After this period, large scale development of unused and virgin lands, commenced in the area.

During a single decade over one million hectares of formerly neglected or unused lands were opened up for cultivation. Drastic changes in habitats and increasing disturbance as well as wide use of pesticides rapidly decimated the Great Bustard populations. Only at the beginning of the 1980's, due to special protection measures, its decline was arrested and the population stabilised at the level of about four thousand individuals.

Since the Great Bustard's reproductive cycle coincides favourably with the seasonal agricultural activities and because of effective conservation measures its population within the Steppe along the Middle Volga river reached six to seven thousand individuals by 1985 and about ten thousand individuals by 1990.

Presently the Great Bustard population is increasing rapidly. The yearly increase has ranged up to one thousand individuals on an average for the last five years. The 1995 spring survey indicates a population of 14-15 thousand individuals, in the Middle Volga Steppe region. Continuation of such or even more rapid increase is predicted on the basis of the present state and trends in agriculture.

During the period of reforms, i.e. 1992-1994, within the Saratov region, about one million hectares of previously cultivated lands have been neglected due to unremunerative returns. Cattle population has decreased significantly while use of pesticides and other chemicals has practically ceased. These favourable factors have also lead to an increase of the population of the Little Bustard in Steppe regions both along the Volga river and in Western Kazakhstan.

24. STATUS OF THE GREAT INDIAN BUSTARD IN 1994

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The Great Indian Bustard *Ardeotis nigriceps*, is one of the rarest birds of India and one of the rarest bustards of the world. In the mid 1980s, bustard population was estimated to be between 500 to 1500, with almost 50% of the birds surviving in Rajasthan. This large variation in the estimate was mainly because Rajasthan could not be surveyed properly.

We have been monitoring the bustard populations during the last 15 years. Our studies reveal that bustard population has declined by almost 50% all over the country. Our studies indicate that there may be around 750 bustards left. The bustard still survives in six states but its number is precarious in Madhya Pradesh, Gujarat and Karnataka. Rajasthan, where more than half of India's bustards are living has not taken effective measures. It is seen in many areas in the Thar Desert but conservation measures are inadequate to face the increasing pressure of livestock and human populations. Over-grazing, human disturbance, increase in blackbuck numbers resulting in resentment by villagers, poaching and mismanagement of habitat are some of the common problems faced by bustard sanctuaries.

There is no coordination among states for bustard conservation. As the bustard (and floricans) are flagship species of the Indian grasslands, their conservation is intimately linked with the protection

of grasslands. The grasslands are the most neglected ecosystems in the protected area network in India. There is an urgent need to start 'Project Bustard' on the lines of Project Tiger and Project Elephant, to protect all the four species of Indian bustards and other species inhabiting grasslands.

25. FIFTEEN YEARS OF CONSERVATION OF THE GREAT INDIAN BUSTARD *Ardeotis nigriceps* IN MAHARASHTRA

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As a result of effective conservation measures taken by the State Forest Department from 1980, population of the Great Indian Bustard *Ardeotis nigriceps*, has shown some increase in few selected areas such as Nannaj. This "resurgence" of the species was mainly due to the setting up of protected grasslands and woodlot plots under the Drought Prone Areas Programme (DPAP). During 1981-85, estimated population for Maharashtra was in the range of 55-60 which has now increased to about 100 birds.

During the early 1980s, only one, rarely two, cocks were seen displaying regularly in Nannaj but by 1994, four to five cocks had established territories in the area. Adult males have also started displaying in surrounding DPAP plots such as Gangevadi, Boramanni and Karmala. Hens have been seen nesting in these areas.

At the Jawaharlal Nehru Bustard Sanctuary, Nannaj, where intensive studies have been carried out, the numbers have increased from 8-10 birds in 1981 to 45-50 today. Earlier the birds were seen only during the breeding season (June-November), now they are resident throughout the year and they can be seen nesting even during March and April.

The Great Indian Bustard is presently distributed in the districts of Solapur, Ahmednagar, Aurangabad and Osmanabad, besides recent reports from Pune and Nagpur districts. These pockets of bustard distribution are mainly in the semiarid parts of the State. Detailed surveys and ecological studies on the species in Maharashtra started in 1981. This paper highlights the latest threats to bustards in the Great Indian bustard Sanctuary and recommends measures for long-term protection of this endangered bird.

26. CURRENT STATUS OF BUSTARDS (OTIDIDAE) IN IRAN

B. BEHROUZI-RAD

There are three species of Otididae in Iran, Great Bustard *Otis tarda*, Little Bustard *Otis tetrax*, and Houbara Bustard *Chlamydotis undulata*. Two species, *Otis tetrax* and *Chlamydotis undulata* are endangered and have been listed in the Red Data Book. Great Bustard is native in Iran and its population is less than 100 individuals. A small population of this species migrates from Turkmenistan to northern Iran. Little Bustard is a winter migrant in the Dast Moghan region of north western Iran and its population is about 10000-12000 individuals.

Houbara bustard is native to central parts of Iran and migratory in the southern steppes of Iran. Migratory population of this species is estimated at about 2000 individuals, the status of its breeding population is not clear.

27. IN THE NAME OF GOD GREAT BUSTARD STATUS IN ISLAMIC REPUBLIC OF IRAN

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Between 1990 and 1995, known bustard habitats were surveyed. Distribution, reproduction, population, behaviour and also habitat destruction factors, which have some adverse effects on Great bustard *Otis tarda*, population were studied.

The previous surveys revealed that the distribution of this bird was limited to west, east and north-east of I.R. of Iran. Therefore, the present studies were focussed mainly throughout these areas of the country.

In eastern province of I.R. of Iran (Khorasan) seven habitats were surveyed, but no bustards were observed. Evidence indicates that a small wintering population of about 200-250 birds survives in the east.

There are many suitable habitats in the western provinces such as: West Azarbaijan, eight habitats, East Azarbaijan, one habitat, Kordestan, five habitats, Kermanshah, seven habitats, and one habitat in Hamadan. The studies indicate that the Great bustard winter and breed in western parts of Iran. It is known that a few Great bustards breed in western Iran, however, a larger population breeds beyond the northern boundaries of Iran.

Considering all available information at least sixty females are breeding migrants to Iran. Total population during autumn and early winter is estimated to be around 200 to 300 birds. In comparison with the population 10-15 years ago, the great bustard populations in western Iran are more or less stable.

28. CURRENT STATUS & CONSERVATION OF THE BENGAL FLORICAN IN NORTH-EAST INDIA

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The Bengal Florican *Eupodotis bengalensis*, is among the most threatened bustards of the world. A bird of the tropical moist grasslands, it is threatened by habitat destruction and occasional hunting and trapping. This paper discusses its current status and conservation measures initiated in North Eastern India, especially in Assam and Arunachal Pradesh. More than half of the known world population of the florican are found in Assam.

The present study indicates that besides Manas, Orang, Kaziranga and D'Ering, all known areas of the Florican, the species is also found in Laokhowa, Burhachapori, Kochmora, Dibru-Saikhowa, Sadiya, Hugrajuli, Kobo Chapori (all in Assam) and the chapories of the Dibang, including Dibang reserved forest and Sirkee proposed reserved forest and the Lohit river, all in Arunachal Pradesh. All these areas should be protected on a priority basis.

Encroachment for settlement and cultivation, overgrazing, commercial thatch cutting and uncontrolled burning of grass are the major threats to its habitat. Moreover, presence of extremists in some areas like Manas, make enforcement of wildlife laws difficult.

29. ECOLOGY OF THE BENGAL FLORICAN IN THE MANAS NATIONAL PARK AND ITS STATUS IN ASSAM

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The Bengal Florican *Eupodotis bengalensis*, is perhaps the most endangered among the 22 species of bustards of the world. The preferred habitat of the Bengal Florican is the alluvial grasslands of the Himalayan terai/duar and the Brahmaputra valley. It is becoming rare owing to the destruction of its habitat.

In India it survives in many disjunct pockets in Assam, West Bengal and Uttar Pradesh. Assam has possibly more than half of the world's population of the Bengal Florican, but even there they are restricted to isolated pockets.

In spite of being a game bird very little is known about this elusive Florican. This study was conducted in the Manas Wildlife Sanctuary and Tiger Reserve from February 1987 to September 1989.

Our studies on the Bengal Florican show that alteration of the grassland habitat into agricultural fields or forest plantation is now the major threat to this species. The grassland habitat of the Bengal Florican is well protected in parks like Kaziranga, Pabitora and Orang but not in the reserve forests. Nevertheless there are still some grasslands which if managed and protected properly could again be colonised by the floricans. We strongly recommend that such grasslands should be managed for the conservation of the Bengal florican and tree plantation should be strictly avoided in such areas.

Nothing is known about the non breeding habits and habitats of the Bengal Florican. Radio telemetry seems to be the only reliable way to solve the problems.

Wednesday, 14 February, 1996

Technical Session IV

CONSERVATION OF RAPTORS

30. SATELLITE TRACKING OF ASIAN RAPTORS

BERND-ULRICH MEYBURG

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31. ADVANCES IN FIELD IDENTIFICATION OF INDIAN RAPTORS

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**32. UNEXPECTED PARADOX; NEGATIVE CONSEQUENCES OF PROTECTION
OF SMALL FOREST SPOTS FOR RAPTORS NESTING ALONG
A NORTHERN STEPPE LIMIT IN EUROPEAN RUSSIA**

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Small forests amidst the Steppe zone including its cultivated northern part are highly populated with raptors. For example a total density of 7 raptor species is 5.3 pairs/sq.km within Plushchan (3.2 sq km along the Upper Don river) and up to 14 pairs/sq.km (8 tree-nesting species of birds of prey and owls) along forest-strips (6.7 sq.km) in the Kamennaya Steppe (Voronouh region). However within protected forest a number of some raptors are decreasing: for example the Kestrel *Falco tinnunculus*, Red-footed Falcon *F. vespertinus* and some others in the Central-Chernozem Nature Reserve (Kursk region). Within the Plushchan practically all raptor pairs nest close to places often visited by people including isolated forest micro-fragments (0.1 - 0.5 ha). Both decline and ousting of raptors are often result of direct (of raptor nests themselves) and indirect (of magpie, raven and crow nests used by small falcons and owls) predation by martens *Martes martes* and *M. foina* which are "magnetized" to small protected forests among an open landscape. In small recreational forests nearby Lipetsk city (Upper Don river) martens are not hunted; therefore they destroy over 40 per cent of nests of owls, large woodpeckers and some other birds. Thus due to protection and weakening of hunting pressure on martens they move south and occupy one by one small forest spots in the Steppe Zone. It results in unexpected danger to forest-steppe raptors and other middle sized birds in southern European Russia.

33. RADIO TRACKING OF GRIFFON VULTURES IN ISRAEL AND THE MIDDLE EAST - ITS APPLICATION FOR RESEARCH AND CONSERVATION

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Home-range size and the pattern of use of selected habitats for foraging by Griffon Vultures *Gyps fulvus* were investigated. Eight birds (six juveniles and two adults) have been tracked in Israel by means of radio-telemetry, between 1992 and 1996. Conventional VHS telemetry has been used to track five birds (two adults and three juveniles) and three juvenile birds have been tracked by the Argos satellite system. The use of conventional telemetry has proved to be extremely difficult for this species as a result of its very large home-range size and high speed movements. Satellite telemetry, however, has proved to be the best technique to track the movements of this species. The data presented in this paper is mostly of the three juvenile birds that were radio-tracked by satellite. These birds have shown a remarkable similarity in their habitat selection and home-range exploitation, foraging mostly in the central Golan area in northern Israel and avoiding most other neighboring areas. The selected foraging range comprised mostly of an open upland pasture area, used mainly for cattle grazing. Consequently, it is suggested that the birds systematically forage in an area of higher food density and availability compared to neighboring areas. Two of the tagged birds conducted a migratory movement from the north of Israel to Turkey.

34. BIRDS OF PREY POPULATIONS IN GRASSLAND AND AGRICULTURAL HABITATS OF NORTHERN-CENTRAL INDIA

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Northern-Central India (Delhi and vicinities; c. 50,000 sq.km) is highly populated agricultural region with some grassland habitats. In 1967-1971 birds of prey populations there totalled 120-150 thousand breeding pairs including 71.5 thousand pairs of Whitebacked Vulture *Gyps bengalensis*, 22 thousand pairs of Pariah Black Kite *Milvus migrans*, 15 thousand pairs of Egyptian Vulture *Neophron percnopterus*, 5 thousand pairs of Blackwinged Kite *Elanus caeruleus*, 5 thousand pairs of White-eyed Buzzard *Butastur teesa* and over 10 thousand pairs of other 11 raptor species. An average density was about 250 breeding pairs per 100 sq.km. It was 15-20 times higher than average breeding raptor density within the central region of European Russia. The major causes of high numbers of birds of prey in India were: (1) abundant food supply, a large bulk of which was in fact provided by people (garbage, carcasses of cattle, wild animals killed by traffic) and (2) traditional good-will of Indians to wildlife including birds of prey.

35. STATUS AND DISTRIBUTION OF RESIDENT RAPTORS IN INDIA

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Raptor surveys were carried out in various protected areas in different bio-geographic zones of the country to obtain information on the status and distribution of resident raptors. Surveys were carried out in 34 protected areas, adjacent forests and also along the highways all over the country.

A raptor species, Grey Faced Buzzard *Butastur indicus* was added to the check-list of the raptors of the Indian Sub-Continent. Two species, viz. Lesser Spotted Eagle *Aquila pomarina* and Lesser Fishing Eagle *Ichthyophaga humilis*, have become very rare and require immediate attention. Great Nicobar Serpent Eagle *Spilornis klossi* and Nicobar Sparrowhawk *Accipiter butleri* which were never very common, are also very rare and require immediate attention. Range extensions of Oriental Honey Buzzard *Pernis ptilorhyncus* and Amur Falcon *Falco amurensis*, in the Andamans, Rufousbellied Eagle *Hieraetus kienerii* in Gangetic plains, Changeable Hawk Eagle *Spizaetus cirrhatus* and Besra Sparrowhawk *Accipiter virgatus*, in Nicobar, were recorded. The Amur Falcon was recorded nesting in India for the first time since 1928.

The recommendations for Raptor conservation in India are also discussed.

36. PRELIMINARY ANALYSIS OF CHANGES IN POPULATION OF WINTERING HARRIERS IN ANDHRA PRADESH INDIA

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The population changes of three species of wintering harriers viz Marsh harrier *Circus aeruginosus*, Montagu *C. pygargus* and the Pallid harrier *C. macrourus* was followed for a period of 7 years from 1986 to 1994 at a grassland roost site near Hyderabad, India. Number of harriers differed significantly between years and reached a maximum during the 1988-1989 season and minimum during 1986-1987. The population changes within a season was not different between years. Maximum numbers are seen in October and there is no significant increase in the March-April spring migration period. This suggests a different route followed by these birds during this season.

Circus aeruginosus accounted for about 50% of the population followed by *C. pygargus* and *C. macrourus*. Males of all the three species were always less in number than females.

Local proximate factors like habitat disturbances and predation affect their population levels. Population regulation may also be tuned to food resource factors for certain species like the *C. aeruginosus*, for others it is not very clear. Measures for identification and protection of roost sites are discussed.

37. ON THE QUESTION OF POPULATION OF PARIAH KITE

Milvus migrans govinda IN DELHI

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A study carried out between 1973-1976 at the National Zoological Park and nearby areas in New Delhi on the breeding biology, growth, development and reproductive success of the Black kite, *Milvus migrans*, estimated 3000-3400 pairs of Birds of Prey within Delhi (150 sq.km). During the period 300-400 kites were observed to roost on trees at the Zoological Park and almost equal number of kites were roosting in a garbage dump outside the boundary of the Zoological Park.

A cursory survey of nesting and roosting areas in the Zoological Park and nearby areas in late 1994, indicates that there is no appreciable decrease in the population of the Black kite in the study area even after a gap of twenty one years. The habitat has undergone sea change over the years as large forested areas have been cleared for stadiums, multistoried buildings. This loss of habitat for raptors has been compensated by the increase in number of garbage dumps, chicken farms, slaughter houses etc.

38. HARRIERS OF THE VELAVADAR NATIONAL PARK, DT. BHAVNAGAR, GUJARAT

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More than 2000 harriers of three species have been reported roosting in the winter in the Velavadar National Park, district Bhavnagar, Gujarat. The present study was initiated to determine the underlying causes for the large congregation of harriers, the species composition and the population structure of the species roosting. The species reported at the roost are the Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus* and a few Marsh Harriers *Circus aeruginosus*. There have also been reports of the Hen Harriers *Circus cyaneus*, though not as commonly seen as the other three species. It was recorded that the harriers largely utilize the Park for roosting and disperse during the day in the nearby cotton fields for foraging.

The suggestion for the protection of the roost are also given.

39. THE IMPLICATIONS OF CROSS-HABITAT USE BY GRASSLAND RAPTORS

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A joint Hawk and Owl Trust/BNHS project has been investigating the ecology of what is currently believed to be the largest winter harrier roost in the world. Situated in the relic grassland of Velavadar National Park in the Bhavnagar District of Gujarat, India, it attracts up to about 2000 harriers, mostly Montagu's Harriers *Circus pygargus*. The grassland is depended on as a night roost, but supports few harriers by day. The harriers are an important component of the low-input agriculture of this semi-arid region by feeding on large numbers of locusts in crops such as cotton. In a season of poor monsoon rainfall and low cropping, few harriers used roost. An ecological parallel can be drawn with the author's study in England of wintering Hen Harriers *C. cyaneus*, roosting in lowland heathland and feeding principally on small passerines that depend on the seeds of persistent weeds in neighbouring arable farmland. Assessment of the value of fragmented habitats to wide-ranging fauna such as raptors must take into account the influence of external land-use practices, particularly on the food supply. The current ecology of such habitats is, for raptors, as part of the surrounding environment.

40. ILLEGAL TRADE OF RAPTORS IN INDIA

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&

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Falconry has been a traditional sport in many parts of the world. Trained falcons have been used for hunting birds such as partridges, quails, bustards, stone-curlews and small mammals like hare.

A recent survey done by TRAFFIC - India on bird trade shows 13 species of raptors in trade. A total of 118 raptors were seen in nearly 100 surveys in trading areas. Owing to very high returns, the trade in raptors is highly profitable. The entire trade is illegal because all raptors are protected under the Wildlife (Protection) Act, 1972.

The survey reveals that most of the large falcons caught are smuggled out to middle east countries, through Pakistan and Nepal. Many falcons are smuggled inside false bottom baskets of Beetle leaves. To immobilize during the journey the wild caught raptors, their eyelids are stiched and camphor pills are administered.

The study highlights the method used for transportation and trapping of raptors and *modus operandi* of the trade. Four ways of catching raptors were noted. The study also shows that a high percentage of raptors are accidental or lucky catches to trapper in India. Despite very high returns, not many trappers go exclusively for catching raptor.

41. KLEPTOPARASITISM IN RAPTORS AT KEOLADEO NATIONAL PARK, BHARATPUR, RAJASTHAN

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Kleptoparasitism in five species of raptors was studied at Keoladeo National Park, Bharatpur, between 1984-1988. The direct observation method was followed. The Kleptoparasitism or piracy which is an opportunistic way of supplementing food was found to be prevalent among raptors in the park. In Kleptoparasitism dominance ratio shows existence of a social hierarchy in the raptors. The piracy on individual fish eating heronary species varies and similarly there is a significant variation in the number of individual raptors pirating the fish eating heronary species. Herons were pirated most by the Pallas's Fishing Eagle *Haliaeetus leucorhynchus* and Imperial Eagle *Aquila heliaca*. The Steppe Eagle *Aquila nipalensis*, rob of the Painted Stork *Mycteria leucocephala*, the most. The Greater Spotted *Aquila clanga*, and Marsh Harrier *Circus aeruginosus*, pirated the Pond Heron *Ardeola grayii*, the highest number of times.

Poster

42. BIRD HAZARDS TO AIRCRAFTS: THE INDIAN SCENARIO

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Bird hazard to aircraft has become a serious cause of concern during the recent years. Every year the Indian Aviation loses more than 300 crores to bird strikes. The BNHS has been studying the problem of bird hazard to aircraft since 1980. The present paper analyses the bird strike reports received over the last 15 years. The reporting agencies include Indian Air Force, Indian Navy, Airports Authority of India, Indian Airlines, Air India and Airtaxi operators. Ninety nine aerodromes from all 10 biogeographic zones of India have been sending information to BNHS. Data from 1839 reports was analysed. The findings show that incidents are most frequent in the months of October and September. The incidents occur mostly between 0600 hrs and 1000 hrs. The six bird species most frequently involved in such incidents, are Pariah Kite *Milvus migrans*, Whitebacked Vulture *Gyps bengalensis*, Blue Rock Pigeon *Columba livia*, Ring dove *Streptopelia decaocto*, House Swift *Apus affinis* and Redwattled Lapwing *Vanellus indicus*.

Wednesday, 14 February, 1996

Technical Session V

CONSERVATION OF WADERS, STORKS AND HERONS

43. CONSERVATION STATUS OF STORKS, IBISES AND SPOONBILLS
THROUGHOUT THE WORLD

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There are twenty species of storks, twentyseven ibises and six spoonbills distributed throughout the world. The largest numbers are found in the tropics of Africa, Asia and South America. Twelve species are endangered or threatened and of these most (9) are found in Asia and three in Africa. In addition, there is concern for subspecies or populations of other species. Major threats are loss and degradation of habitat alongwith human disturbance, hunting and the effects of pesticides.

Among the thirteen species of these birds found in India, three are endangered or threatened. The Greater Adjutant Stork is one of the rarest storks in the world. A population of about 400 birds persists in Assam and a smaller population persists in southeast asia. The endangered oriental White Stork, a bird of east-central and northern asia is only rarely seen in India. There is concern for other species such as the Blacknecked stork. While the status of other species appears to be stable, there is often little census data to determine short or long-term trends.

44. STATUS AND CONSERVATION OF INDIAN HERONRIES

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This paper discusses the current information available on the colonial waterbird nesting sites (heronries) in India. Information gathered on over 350 nesting sites of 19 species of Pelecanidae, Phalacrocoracidae, Ardeidae, Ciconiidae and Threskiornithidae indicate that only a small proportion of heronries come under protected areas. While only a very few sites have been in existence for over a century, a number of sites have come into existence in the last half a century. Analysis of available information indicates that there is variation in the number and type of species nesting in differnt states in India and habitats in which the nest sites occur, with a number of heronries associated with human habitations. Seasonal variations in the nesting of certain species exist in different regions of the country. Over the last century, about 170 sites have been lost due to various factors and the existing sites are prone to a number of threats and disturbances. Distribution of heronries indicates that their occurrence in different parts of the country is closely linked to the availability of suitable feeding conditions. Current status and future options for conservation of heronries in India are discussed.

45. STATUS SURVEY OF STORKS IN UNPROTECTED AREAS OF BRAHMAPUTRA VALLEY IN ASSAM

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Of the nine species of storks found in India, seven of the rarest stork species in the world, including the Greater Adjutant *Leptoptilos dubius*, are reported from Assam. Formerly widespread in northern India, Nepal, Bangladesh, Myanmar, Thailand, Cambodia, Southern Vietnam and Laos, the population of *Leptoptilos dubius*, has declined drastically, with only a few major strongholds in Assam. From the conservation point of view this stork deserves top priority and hence its present status needs to be studied.

In order to determine their status, distribution and nesting sites especially with reference to the endangered storks, an extensive survey of 17 districts was carried out from January to March, 1995 outside the protected areas in the Brahmaputra valley.

The Asian Openbill *Anastomus oscitans* was found to be fairly abundant and in large numbers (798) followed by the Lesser Adjutant *Leptoptilos javanicus* (670) and Greater Adjutant (573). As many as 118 nests of Lesser Adjutant and 71 nests of Greater Adjutant were observed. The highest numbers were found in Nagaon district.

During the survey only one Blacknecked stork *Ephippiorhynchus asiaticus*, three Black storks *Ciconia nigra*, and five Woollynecked storks *Ciconia episcopus*, were observed. This survey updates the information about the status and distribution of storks in Assam, on the basis of which further studies and conservation measures can be planned.

46. IMPACT OF PESTICIDE CONTAMINATION ON FISH-EATING BIRDS -AN INDIAN SCENARIO

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Reckless use of pesticides, often has detrimental impact on non-target organisms including birds. Fish-eating birds are especially vulnerable due to their position in the food chain. Accumulation of persistent chemicals in bird tissues may result in impaired reproduction. Residues of organochlorine group of pesticides and their impact on the population of many species of fish-eating birds have been well documented in several western countries.

Although a little information is available on the level of these pesticides in eggs of a few species of terrestrial birds, no work has been carried out on the impact of organochlorines on fish-

eating birds in India, except the study carried out on eight species in Keoladeo National Park, viz. the Large Cormorant *Phalacrocorax carbo*, Indian Shag *P. fuscicollis*, Darter *Anhinga rufa*, Grey Heron *Ardea cinerea*, Cattle Egret *Bubulcus ibis*, Large Egret *Ardea alba*, Painted Stork *Mycteria leucocephala* and Spoonbill *Platalea leucorodia*.

The organophosphorous and carbamate group of pesticides affect central nervous system of birds while the organochlorines due to their persistent nature, remain stored in the body fat and largely disturb calcium metabolism. This paper emphasizes continuous monitoring of pesticide residues and eggshell thickness in fish-eating birds.

47. POPULATION AND DISTRIBUTION OF BLACK-NECKED STORK *Ephippiorhynchus asiaticus* IN KEOLADEO NATIONAL PARK, BHARATPUR

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The species formerly ranged throughout the entire subcontinent from Sri Lanka southeast through Burma, Thailand, Kampuchea and Vietnam. Within last two decades numbers in the Indian subcontinent have fallen drastically. In India, it remains widespread in Rajasthan, Uttar Pradesh and Assam. In the Keoladeo National Park, five pairs of black-necked storks have been nesting regularly. The birds are highly territorial during the breeding season. Their population and distribution pattern have been noted to vary seasonally. At the end of the breeding season the increase in number of chicks in the park is unusually high, which gives credence to the fact that there is nesting around the park also.

48. TIME ACTIVITY BUDGET OF BLACKNECKED STORK *Ephippiorhynchus asiaticus* (LATHAM) IN DUDWA NATIONAL PARK, UTTAR PRADESH

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Of the nine species of storks in India, the Blacknecked Stork *Ephippiorhynchus asiaticus*, is an uncommon species. It has disappeared from many areas in the country. The Gangetic plains, especially in Uttar Pradesh, constitute its present stronghold. This paper is based on five months of behavioural studies on the stork in the Dudwa National Park.

14 Blacknecked storks were observed inside Dudwa N.P on different wetlands. Owing to their strong territoriality, each pair occupies a separate wetland. A total of 268 hrs were spent observing the activities of the stork (male, female and sub-adult) in three major wetlands, namely Banketaal, Kakrahataal and Radhitaal. More than 50% (169 hrs) of the total (268 hrs.) observation time were spent studying the behaviour of male Blacknecked storks.

The study revealed that the storks spend around 17% of their diurnal activity in foraging, while the greater part (65.24%) is spent in resting. Similarly, the females spend most part of the day taking rest (60.40%, n=86hrs.) and spend only 12% of their time in foraging activities. Amongst the maintenance activities, preening was a major activity, while the rest (e.g. yawning, wing stretching and bathing) were of very short durations. Unlike most birds, the Blacknecked storks do not have any specific time for foraging or resting.

49. SOME ASPECTS OF FORAGING STRATEGY AND FEEDING DISPERSION OF LESSER ADJUTANT STORK *Leptoptilos javanicus* IN THE BRAHMAPUTRA VALLEY, ASSAM

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Aspects of foraging behaviour, feeding techniques and feeding dispersion of *Leptoptilos javanicus* has been studied in detail in the Brahmaputra valley since 1988. 14 types of feeding behaviours were categorized. Probing activity is inversely proportional to steps and the success rate varies in single probe and multiple probes. The rate of multiple probe was 86.77 ± 0.86 SE/minute. The pace rate per minute was found to decline in vegetated wetland and the average rate of steps in all habitats studied was $35.81 \pm .035$ SE.

Foraging strategy employed by the storks in muddy and vegetated wetland habitat is most important for successful predation. During multiple probes the birds wade with their bill at an angle of $90^\circ - 120^\circ$ to the ground. At the beginning, the bill is inserted into the substratum at an angle of 45° while tibia and tarsus bend at knee.

The feeding dispersion was found to be divergent and at the initial stage of daily feeding trips, the storks employed three different types of feeding movement. The dispersion is regular with a mean flock size of $2.8 \pm .054$ SE. The high turning rate and scattering tendency is characterised by zig-zag individual foraging movement.

50. SOME ASPECTS OF THE BREEDING BIOLOGY OF GREATER ADJUTANT STORK *Leptoptilus dubius* IN BRAHMAPUTRA VALLEY, ASSAM

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The greater adjutant stork *Leptoptilus dubius*, is an endangered species and its breeding colonies are distributed in some isolated pockets of Brahmaputra valley. Being a crucial aspect of conservation efforts, emphasis has been laid on the study of the breeding biology of the species.

The study was taken up between 1989 - 1995 at 11 existing nesting colonies located in seven districts of the valley. Altogether 4500 hours were spent in nest observation. These covered various aspects of nesting and measurements of nests and eggs. Overall reproductive success of the species was also covered under the study.

The nesting colonies were controlled by some crucial conditions, including ultimate and proximate factors. The clutch size varied from 2-3 but 3 was common. The overall clutch size in all seasons and colonies was 2.61 ($n = 278$). Incubation period was 30 days, with 90% hatching success. Overall nesting success was 61.30%.

The chicks were fed small live fish particularly those belonging to the *cobitidae* and *cyprinidae*, till about one week, then they were gradually offered larger morsels. The parents offer live vertebrate food, till about seven weeks then gradually start offering miscellaneous animal food. These food items compensate during periods of food shortage and have an impact on the ultimate reproductive success.

51. STATUS OF PAINTED STORKS IN GUJARAT

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Painted Stork *Mycteria leucocephala*, is a colonial nesting bird. Its breeding colonies in Gujarat were surveyed, population of breeding pairs estimated and colony characteristics noted. In Gujarat, 15 active colonies exist today in which less than 1000 pairs breed annually. Only three colonies exist in natural habitat, remaining ten are located in rural areas and two in urban areas. The colony size is much smaller near exclusively fresh water habitats as compared to those near the sea coast and estuary. Total seven colonies have been lost during recent past of which four were lost during the last five years, due to human disturbance. Factors affecting breeding ecology and conservation measures required for various colonies are discussed.

52. STUDIES ON SOUTH POLAR SKUA IN AND AROUND MAITRI, SCHIRMACHER OASIS, ANTARCTICA

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The Indian Antarctic station Maitri is about 80 - 100 km from the open sea and is situated in the Schirmacher Oasis, area c. 34 sq. km., located between $70^{\circ} 44' 33''$ S to $70^{\circ} 46' 30''$ S and $110^{\circ} 54' 00''$ E, on the Princess Astrid Coast. The low lying hills in the oasis are interspersed by many glacial lakes which constitute the breeding sites of the South Polar Skua.

Studies on South polar skuas were conducted in and around the oasis. Their nesting and breeding success were studied and compared with observations over several years. Out of six breeding pairs only one pair could breed successfully. One Adelie penguin and six skuas, including one chick and five adults, were ringed to study the population density and migratory pattern. A total of ten nests were sighted during the present study.

53. BREEDING OF SPOTBILLED PELICANS IN CAPTIVITY

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This paper discusses the design of an aviary and the development of captive breeding techniques for the endangered Spotbilled Pelicans *Pelecanus philippensis* at the Bannerghatta National Park. The pelicans along with other waterbirds are being maintained in a fully enclosed walk-in aviary, which is flooded with water to create zones with different depths. A regular supply of fishes is maintained. The pelicans have been breeding since the last breeding season. Future programmes for enhancing the breeding potential of the captive population and the rehabilitation of the nestlings born in captivity are detailed.

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54. REGIONAL VARIATIONS IN THE DIET OF THE NESTLINGS OF CATTLE EGRET

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The food offered to their nestlings by the Cattle Egret *Bubulcus ibis* at four different heronries was analysed to determine regional variations, if any. The nestlings were scared, as a result they regurgitated the food stored in their crop. Such food samples were collected, preserved in alcohol and analysed.

There were marked differences in the quality and quantity of the food offered to the nestlings at four heronries, arthropod diet ranged from 26.43% to 92.3%. Though the total contribution varied, Coleopteran and Orthopteran were two important orders in the diet. Most of the arthropods were serious pests of agricultural crops. The Cattle Egret turned out to be the most important avian predator, suppressing population growth of agricultural crop pests.

Heronries of Cattle egrets and other ardeids, were left undisturbed by the local people. With increasing irrigation facility and year round cultivation, the population of Cattle egrets and other ardeids is likely to increase, provided their beneficial role, in controlling insect pests of agricultural crops, is highlighted and such heronries are encouraged.

POSTER

**55. PRIORITIES FOR CONSERVATION OF KOKRE BELLUR HERONRY
IN KARNATAKA, SOUTH INDIA**

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Kokre Bellur village in Mandya District provides a unique case study of co-existence of humans and birds. Destruction and degradation of feeding and foraging habitats threatens the very existence of these heronries. The Spotbilled pelicans *Pelecanus philippensis* and Painted storks *Mycteria leucocephala* are globally endangered species, constituting the dominant, breeding waterfowl population in the heronry.

On the basis of continuous survey and monitoring of the populations of heronry species for over a decade, following management practices are suggested for the conservation and sustenance of these heronries.

- i) The well-watered tracts, major tanks and river-courses around villages should be left undisturbed for waterfowl. Sulekere, Maddur, Bolare Koppalu, Gutlu Kere, Marchalli, Malavalli, Thailur, Shettolere and the surrounding lakes within 50 sq. km. of heronries should receive attention. Cauvery and Shimsha river courses should be kept free from disturbance and pollution. Some of the above lakes can be declared as 'protected' by the state government.
- ii) The feasibility of erecting artificial nesting platforms on experimental basis be explored.
- iii) Selective enhancement of floral elements, to counter shrinking of habitat and decline of heronry populations is required urgently.
- iv) Factors such as tree cutting, hunting, water pollution, etc. be checked. Provision of plastic sleeves around live wires in the proximity of heronry trees is urgently required.
- v) Kokre Bellur should not be popularised as a tourist spot.
- vi) The Carp *Cyprinus carpio*, Catla *Catla catla*, are some of the primary food-fishes. Stocking of such species in important water bodies around the heronries will be helpful.
- vii) The world breeding population of spot-billed pelicans is less than 2500 breeding pairs in India, Cambodia and Srilanka. A joint research and conservation programme is required.

POSTER

56. OBSERVATIONS AT KOKRE BELLUR HERONRY AND THEIR IMPLICATIONS ON CONSERVATION

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A census of the Spotbilled pelicans *Pelecanus philippensis* and Painted storks *Mycteria leucocephala* was conducted during the nesting season. The counts revealed the numbers of storks to range between 850 and 900; and that of pelicans between 300 and 350. The aggregation of nests appeared to follow the aggregation pattern of trees. Eighty per cent of nests were located adjacent to houses in the village. Degree of clumping was related to the nesting success and survival of nestlings.

The trees holding nests of pelicans and storks included *Ficus balerica*, *Thespesia populnea*, *Delonix allata*, *Tamarindus indica*, *Melia dubia*, *Albizia lebek*, *Azadirachta indica* and *Ficus bengalensis*. Larger the canopy size of the tree, greater was the number of nests and the nesting success. Instead of nesting on the outskirts of the village, birds preferred to nest on trees in the village. This suggests that aggregation of trees within human habitations confer multiple advantages to the birds. Implications of these observations on conservation of birds is discussed.

POSTER

57. STATUS OF STORKS IN KEOLADEO NATIONAL PARK

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Of the world's 19 species of storks, nine species are found in India and five out of six resident species are found in Keoladeo National Park. These are Openbill stork *Anastomus oscitans*, Painted stork *Mycteria leucocephala*, Whitenecked stork *Ciconia episcopus*, Blacknecked stork *Ephippiorhynchus asiaticus* and Lesser adjutant *Leptoptilos javanicus*. Earlier the Greater adjutant *Leptoptilos dubius* was also seen in the park. Amongst the resident species, Painted and Openbill storks are colonial breeders, while the Whitenecked and Blacknecked storks are solitary breeders.

The present study was initiated in November 1994. In 1994, six pairs of Blacknecked stork nested but only one bred successfully with three chicks, another had two chicks which died before fledging, while the remaining four pairs abandoned their nests. Three pairs of Whitenecked storks nested inside the park in 1994. Status of Openbill and Painted storks appears to be stable.

POSTER

58. SIGHTINGS OF THE DOUBLE BANDED COURSER *Cursorius bitorquatus* IN EASTERN GHATS

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The Double banded Courser, *Cursorius bitorquatus* is a solitary species of great rarity, still extant in a small portion of peninsular India. Due to its rarity and inadequate ornithological surveys after 1900, it was assumed to be extinct. The species was rediscovered after eight decades in a compact area of the eastern ghats in peninsular India.

This paper describes the studies conducted on the species during the last three years. It also gives information on recent sightings in the area. Measures for habitat conservation are also discussed.

POSTER

59. SAVING SPOTBILLED PELICANS AT KOKKARE BELLUR IN KARNATAKA

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Kokkare Bellur in Mandya district of Karnataka is one of the sites where the endangered Spotbilled Pelicans *Pelecanus philippensis*, breeds regularly. The pelicans along with painted storks nest on trees found amidst houses in the village. Over the years, this pelicanry has dwindled dramatically. From a population of over 2000 breeding birds about 30 years ago, the numbers have dwindled to a mere 330 nesting birds today.

Three major factors namely, loss of preferred trees, damage to nesting trees and the loss of nestlings which fall down from their nests due to over-crowding, contribute to the decline of the pelican population at Kokkare Bellur. This paper discusses the conservation strategies to save the birds and the nesting colony.

POSTER

**60. 'ANRIL' - AN ENDEMIC RACE OF BLACKIBIS POPULATION OF
TAMIL NADU, INDIA**

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The southern end of Tamil Nadu, which is a semi arid zone provides a suitable niche for a population of Blackibis *Pseudibis papillosa*. This has neither been recorded in scientific literature nor in district gazetteers. But the habitat and social life of this population of blackibis is well recorded in Sangam Tamil Literature as ANRIL.

This population of blackibis shows morphological differences from the rest of the population on the shoulder that covers a major portion of median wing coverts and also in having an orange-yellow coloured iris against the orange-red colour iris of the known population. This population can be recognised as a seaparate race on the basis of morphological characters and also, since it is separated from the other known population which as per available literature does not extend below Nellore in Andhra Pradesh and Nanjankod in Karnataka.

POSTER

**61. RECENT RECORDS OF THE WHITE-BELLIED HERON FROM ASSAM AND
ARUNACHAL PRADESH**

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The White-bellied, Great white-bellied, or Imperial Heron *Ardea insignis*, is an extremely rare heron. Very little information is available on its distribution and status. This report presents the current status of this little-known bird in Assam and Arunachal Pradesh in north-eastern India. During the course of field surveys, the white-bellied heron was observed in Jamjing Reserved Forest, Dibru-Saikhowa Sanctuary, Kaziranga National Park, Pobitora Sanctuary (all in Assam) and Namdapha National Park (Arunachal Pradesh).

Usually seen singly, six birds have been sighted in the same wetland in Pobitora Sanctuary in October, 1995. Although no nest could be located, further search is on to locate the same. Namdapha, Kaziranga and Orang contain potential nesting sites. In disturbed areas, the bird haunts secluded waterbodies while in protected areas like Kaziranga, it is commonly seen in opener beels.

Wednesday, 14 February, 1996
Technical Session VI
CONSERVATION OF WETLANDS

**62. CONSERVATION OF INDIAN WETLANDS;
AN EVALUATION OF THE WISE USE MODEL**

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Wise use is defined as the sustainable use of wetlands for the benefit of humankind in a way that is compatible with the maintenance of the wetlands' natural properties. An important first step in developing a wetland policy based on wise use would be a detailed study of various wetland types in India to determine how these wetlands are currently being used and the effects of this use on the wetlands' hydrology, vegetation, animal populations, water quality, etc.

The concept of wise use raises many practical questions that need be addressed if it is to be used as a basis for national wetland policy. What is the wise use of any given wetland? Who decides what the wise use of a particular wetland will be? How is wise use distinguished from exploitation in the short term and long term? Can the wise use of a wetland change over time? Reliable answers to these questions can only come from a sound understanding of the ecology of a wetland and how it is being used.

The wetlands of the Keoladeo National Park in Rajasthan are one of the few wetlands in India that have been studied in sufficient detail to provide meaningful answers to these questions. The results of studies initiated by Dr. Salim Ali and carried out by the Bombay Natural History Society and others in the Keoladeo National Park will be used to evaluate the utility of the wise use approach in India.

**63. LOCATING AND EVALUATING AQUATIC HABITAT USING REMOTE
SENSING**

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Remote sensing, including both satellite imagery and aerial photography, make possible the locating and evaluating of aquatic habitat. A digital terrain model maps the landscape surface, showing the location of stream channels and depressions which may be the location of ponds and wetlands. Color and infrared imagery is used to indicate the location of standing water, identify vegetation and indicate areas of high moisture content. Analysis may be done on a range of scales,

from tens of meters to several kilometers. Most work to date has been with agriculture and forestry, where it successfully identified communities, vegetation condition, and changes over time. We have used both the terrain model and vegetation analysis to locate habitat for selected fish species and riparian habitat as part of a program of watershed analysis. Use of information is improved when combined with other types the typical wetlands of the region. 47 species of water-birds are found here. To assess the number of aquatic birds midwinter waterfowl census is recommended.

64. INDIA'S WETLANDS AND THEIR CONSERVATION - AN OVERVIEW

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Man has been making use of the vast resources of wetlands for millenia, apparently without conflicts, since his demands did not exceed the availability of resources. The major river systems of the world, namely the Niger, Nile, Tigris-Euphrates and Ganges among them have supported rich human civilizations, which relied on the productive wetland ecosystems of their delta. However, of late, the scenario has undergone drastic changes. Draining and reclamation, construction of dams, excessive fishing and discharge of agricultural and industrial waste pose serious threats to the survival of many major wetlands, the most productive ecosystem of the world.

Available statistics show that India has about 67,429 wetlands, each 100 ha or more in area, covering a total of 4.05 million hectares. This is a gross underestimate, as there are many wetlands below 100 ha. A reasonable estimate based on a recently concluded study in Etawa and Mainpuri districts of Uttar Pradesh shows that India has 20 - 25 million ha. under wetlands. Protection and conservation of the country's entire wetland is impossible and not warranted. A pragmatic system has to be evolved to protect the biodiversity of selected wetlands for long-term conservation and sustainable use.

India, now, has a well formulated Protected Area Network for forest systems, representing all the major forest types from each of the 11 biogeographic zones. Such a network is lacking for the wetlands, although they are more productive and sustain a sizeable human population.

The paper critically examines: (1) the present status of wetland conservation (2) conservation measures initiated and their inadequacies, (3) further steps to be taken, (4) the need for classifying the country's wetlands based on their biotic and abiotic characteristics, (5) the importance of having a **Protected Wetland Network** representing biogeographic regions and plant and animal community for long - term conservation, (6) the importance of protecting satellite wetlands around the larger ones and (7) measures for the sustainable use of wetlands without compromising their conservation values.

65. THE IMPORTANCE OF ARTIFICIAL WETLANDS FOR THE CONSERVATION OF BIRD SPECIES DIVERSITY IN CENTRAL RUSSIA

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Central Russia is one of the most populated and economically developed areas in the forest zone of Russia. By 1980 more than 80% of river valleys were agriculturally improved, just those areas that have the most important and valuable wetlands. So by now some artificial wetlands correspond more to ecological requirements of waterfowls and shorebirds than most part of natural wetlands. The number and density of broods of waterfowl on different waters are shown.

Fish ponds. These comprise systems of shallow eutrophic artificial reservoirs with floating and meadow isles. Large lakes of more than 50 ha predominate. Thanks to the regular provision of large amounts of fish-fodder, the breeding conditions for waterfowl are also very favourable. More than 50% Central-Russian populations of *Podiceps cristatus*, *P. nigricollis*, *Ardea cinerea*, *Aythya fuligula*, *A. ferina*, *Chlidonias niger* and *Sterna hirundo* inhabit fish ponds. In autumn here can be seen the largest concentrations of ducks, shorebirds, Osprey and White-tailed Eagle.

Excavations of peat-diggings, especially in complex with surrounding eutrophic lakes, also play important role for many bird species, as example *Larus canus*, *Podiceps auritus*, *Ixobrychus minutus*.

Storage reservoirs in Central Russia support more than 50% of nesting regional populations of Osprey and White-tailed Eagle. The problems of artificial wetlands management are discussed.

66. IDENTIFICATION OF WETLAND COMPLEXES FOR CONSERVATION IN THE UPPER INDO-GANGETIC PLAINS OF INDIA

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The wetland habitats in the Indo-gangetic plains support a rich variety of plants and birds. In order to evaluate the plant and bird diversity, a sample survey was conducted in Etawah and Mainpuri districts of Uttar Pradesh during summer and winter. The major objective of this survey was to answer the question how much wetland area is required to protect the diversity of plants and birds in the upper gangetic plains.

We selected 34 wetlands with the help of satellite imageries and Survey of India topo-sheets of 1:50,000 scale. These wetlands fall in three different geomorphic types namely, ox-bow, paleo-channel, lakes and ponds. All the wetlands were shallow (30% are deeper than 1 m) with an average water depth of 1-3 m and a large number of them (45%) were seasonal with more or less clearly defined basins. Altogether a total 44 species of vascular plants and 74 species of birds were recorded. The plant communities comprised of 5 free floating, 6 rooted floating, 11 submergent, 14 emergent and 8 semiaquatic species. The third assemblage comprised of migrant ducks (72%), coots (11%) and rails (5%). The pochards and waders contributed relatively insignificant numbers to the total abundance.

To identify the wetland complexes with required area to support the maximum diversity of plant and bird species, three approaches already available were used. Their consistency and efficiency were compared and a new approach was devised and tried. They are 1) extrapolate a simple species-area curve from the data, 2) cumulatively tally species list as one proceeds from the smallest to largest habitat until the desired number of species is reached, 3) selectively picking from the sites so as to reach the number of species obtained by the two previous methods and finally 4) constructing an Idendrogram from the inter-distance matrix of wetlands, keeping the perennial and largest wetland as the focal one and select the satellite wetlands till the desired number of species is reached. In this way we have identified the wetland complexes in this area so that the maximum diversity of plants and birds can be conserved.

67. ECOLOGICAL EVALUATION OF IRRIGATION TANKS IN NORTHERN TAMIL NADU, INDIA

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North Tamil Nadu, encompasses the Tiruvannamalai Sambuvarayar district (11°96'N to 12°90'N and 78°69'E to 79°78'E) and Chengalpattu MGR district (12°12'N to 13°42'N and 79°32'E to 80°22'E). Agriculture, the prime livelihood of majority of people, in these districts, is sustained by irrigation tanks numbering 5530. The water-spread area of these tanks ranges from 5 to 1820 ha. These tanks are man-made and are known to be 3,000 years old. Except a few, which are fed by the reservoirs, all other tanks are rainfed and seasonal.

This study was carried out, from 1991 to 1995, during four winter seasons (November - March). A total of 653 tanks were surveyed. Out of these, 97 tanks have an area of over 100 ha. Over 10 lakh birds belonging to 69 species have been recorded in these tanks. Even relatively smaller tanks with an area of less than 100 ha were found to harbour an appreciable population of birds, including migratory ducks and shorebirds.

Almost all the tanks have been severely affected by human encroachment, siltation, social forestry, weed infestation, agricultural runoffs, eutrophication, over grazing and poaching. Besides these, prevalence of over 50% of illiteracy among the people of the area is known to be one of the major factors for the deterioration of the tanks and subsequent decimation of their flora and fauna.

68. WETLANDS AND WATERBIRDS OF KERALA - AN OVERVIEW

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Kerala has 41 west-flowing and 3 east-flowing rivers, 27 estuaries, several lagoons, extensive backwaters, fresh water lakes and tanks and 560 Km long shoreline. Added to these are 8,01,700 ha of land under paddy cultivation and many irrigation and hydel reservoirs. Annual average rainfall ranging from 180 cm to 380 cm from both the SW and NE monsoons replenish the waterbodies of the State the year round. Thus Kerala possesses one of the most diverse wetland systems of India.

The pressure for land, changes in land use, shortsighted development plans, uncontrolled use of chemical fertilizers and pesticides etc. are wreaking havoc in this unique wetland system. Apart from a few isolated studies, the biodiversity of Kerala's wetlands and their status and problems are yet to be assessed.

Case studies of nine wetland systems in the State - four estuaries, one lagoon, one hydel reservoir and three areas under paddy cultivation - including vegetation, avifauna, ichthyofauna etc. are presented briefly.

Avifaunal studies and census conducted mainly since 1985 have shown that Kerala's wetlands hold about 200 species of birds, both residents and migrants.

A plan for the conservation and management of our wetlands with the combined efforts of local people, agriculturists, N G Os and Government departments has been put forward.

69. WATER BIRDS AND CONSERVATION VALUE OF MINOR IRRIGATION TANKS IN AREAS OF DHARWAD DISTRICT, KARNATAKA (INDIA)

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The increasing pressures on wetland habitats and the inadequate knowledge of waterfowl distribution and ecology are concerns for which a number of activities relating to waterfowl survey, census, research programmes and workshops are essential.

Dharwad district, in Karnataka, occupies a unique geographical position between 14° 71' - 15° 0' N & 74° 48' E - 76° 48' E covering an area of nearly 8140 square kilometers. The hilly landscape on the western edge of the district has typical tributary drainage of large streams which have helped a succession of bunded tanks for agricultural and piscicultural use. Both in productivity and physical as well as limnological features they enjoy a special status compared to lakes. These aspects are discussed in this paper.

Out of 2000 sites, many occur on the eastern dry-edge and are temporary and short lived. A few long seasonal ones on the western wet-edge of the District attract resident and migratory waterfowl such as ducks, geese, teals, cranes, storks, Ibises, spoonbills, flamingoes, including shore birds like sandpipers, snipes, stints, curlews, dunlins, godwits and others.

The Asian waterfowl census is also documented from these tanks. A survey funded by the Oriental Bird Club (OBC), was initiated in 1992 to study waterbird migration stop-over sites in Dharwad district. A checklist of 60 bird species belonging to 20 families recorded from 54 tanks has been prepared as part of the survey. An annotated list of birds with information about habitat and abundance is given.

70. CONSERVATION AND MANAGEMENT OF SUCHINDRAM AND THEROOR WETLANDS AS WATERBIRD SANCTUARIES FOR AGRICULTURE, TRADITIONAL FISHING AND ECOTOURISM

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The objective of the study was to conserve the biodiversity of Suchindram Kulam and Theroor Kulam, two major tropical freshwater wetlands of Kanyakumari district in peninsular India. Methodology included i. rapid assessment of the biological diversity of these wetlands, ii. monitoring the wetland birds of the area at all seasons of the year, iii. factors endangering these wetlands, iv. assessing the potential role of the birds of these wetlands for agriculture, traditional fishing and ecotourism.

A total of 47 species of wetland birds including 14 migrants were recorded in the study area. These include grey pelican, darter, large egret, painted stork, spoonbill, jacanas, painted snipe and osprey. There are more than 20 species of freshwater fishes and forty species of aquatic plants have been recorded. The major native plant species are *Cryptocoryne* sp., *Ipomoea aquatica*, *Scirpus* sp., *Nelumbium* sp., *Nymphaea* sp., *Nymphoides* sp., *Polygonum* sp., *Trapa* sp., *Typha* sp., *Potamogeton* sp., *Aponogeton* sp. and *Hydrilla* sp., *Eichhornia crassipes* and *Ipomoea cornea* are the two exotic plants dominant in the study area.

Suchindram and Theroor Kulams are traditionally exploited for irrigation of paddy fields. Fishing is an important livelihood for many families. Factors that threaten the wetlands include i. discharge of sewage from the adjacent town ii. proliferation of two exotic weeds, namely *Eichhornia crassipes* and *Ipomoea cornea*, iii. encroachment iv. poaching.

The paper includes an integrated action plan aimed at enhancing the population of aquatic birds at Suchindram and Theroor in order to a. increase agriculture productivity, b. create optimal conditions for traditional fishing and c. develop ecotourism - without disturbing the ecology of the wetlands.

Recommendations include specific measures for a. improving water quality b. eliminating exotic weeds c. desilting d. restoration of shore habitat e. providing nesting trees on mounds f. providing visitor facilities for ecotourism.

71. RESTORATION ECOLOGY AND CONSERVATION OF THE RE-FLOODED HULA WETLAND HABITAT IN NORTHERN ISRAEL

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The drainage of the 6,000 ha Hula Lake and swamps during the late 1950s resulted in the loss of a very unique ecosystem. It was an important station for migrating, wintering and breeding birds, as also a habitat for many plants and fish species. The establishment of the 320 ha Hula Reserve in 1958, did help partial rehabilitation of the original habitats, but failed to prevent species extinction.

The aim of the drainage to reclaim a vast fertile land, has been found to be a partial success due to soil sinkage, peat blown up by wind and underground fires. Predictions that the sinking will continue led the authorities in 1994 to re-flood the valley center, aiming at rehabilitation of wetland attractive to eco-tourism. A study into the original ecosystem was carried out and resulted in an initial habitat reconstruction program.

Thirty-three of the original plant species were spontaneously established and from the reintroduced species, at present three have failed to establish, three show potential success and five species have established well. Although some of the re-established species show stability, some aggressive invader species will have to be controlled for rehabilitation of the vascular plant system as a foundation for building up the original ecosystem.

72. MOORLANDS IN EUROPEAN RUSSIA THE ROLE FOR THREATENED BIRD PROTECTION

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Analysis of bird habitats in Central Russia show that only 3 among 47 endangered and vulnerable species inhabit forest ecosystems proper. The reasons of this phenomenon are discussed. 44 species are connected with intrazonal landscapes, the most important of which are peat (raised) bogs and flood-plain river valleys.

11 endangered and vulnerable bird species nest mainly or exclusively on raised bogs in forest zone; Black-throated Diver, Golden Eagle, Crane, Golden Plover, Curlew, Whimbrel, Great Grey Shrike. During 1988-1993, a network of protected peat bogs in Novgorod and Tver regions was created. The most significant among them are two adjacent, recently created strict nature reserves "Rdejski" and "Polistowski". These reserves, total area \approx 730 sq. km. and the adjoining non-protected zone, support nesting populations of Curlew, \approx 1,500-1,800 pairs and Golden Plover, \approx 200-250 pairs.

Flood-plain valleys support populations of 15 rare and vulnerable bird species, including the globally threatened Corncrake *Crex crex*. Their survival has been possible due to the traditional farming techniques. This paper discusses the flood-plain meadows management, which aids the maintenance of plant succession favourable to birds.

73. CONSERVATION OF AVIFAUNA AT PULICAT BIRD SANCTUARY ANDHRA PRADESH - ISSUES AND CONFLICTS

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Pulicat Bird Sanctuary in southern Andhra Pradesh is a large coastal lagoon spread over an area of about 450 sq.kms. It is a brackish water lagoon and the entire waterspread is heavily influenced by the north east monsoon. During winter the sanctuary supports a large number of palearctic waterfowl from October to March. Eighty eight spp. of birds associated with wetlands were recorded during a study by the Bombay Natural History Society between 1990 and 1993. The sanctuary is a major foraging ground for the endangered Spotbilled Pelican (*Pelecanus philippensis*) and other waterfowl like Painted Stork, Greater Flamingo, Ducks and Waders of several species. The sanctuary is also rich in other biodiversity which includes about 160 species of fishes, 25 species of polychaetes, 12 species of penaeid prawns, 29 species of crabs and 19 species of molluscs. Waterfowl populations in the sanctuary fluctuate considerably depending on the existing water regime. Studies indicate that the sanctuary is on a major flyway route for migratory waterfowl on the east coast of India. The intensive prawn culture operations by various outside groups around this region constitute a major environmental issue for the sanctuary. Uncontrolled anthropogenic activities coupled with the loss of traditional methods of fishing has resulted in serious depletion of local resources. The situation has led to a clash of interest between birds, traditional fishing versus prawn culture. Construction works, mining, industrial development is also threatening the lake's ecosystem and its biodiversity. Studies on the dependence of the local communities on natural resources, developing an action plan to tackle resource conflicts, income generation schemes for the fisherfolk etc. need to be taken up in the region. Conserving the biological diversity through a community based approach is a prerequisite in our efforts to sustainably manage the resources of this wetland.

74. THE LEGAL DIMENSIONS INVOLVED IN CONSERVATION OF THE PULICAT BIRD SANCTUARY

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This paper explores the problems engulfing Pulicat Bird Sanctuary and attempts a legal analysis of the same. It is interesting to note that aquaculture is being carried out in the Sanctuary in blatant violation of existing laws.

The aquacultural activities can be effectively brought to a standstill only when the Wildlife (Protection) Act, 1972, and the Coastal Regulation Zone Notification, 1991, are stringently enforced.

Otherwise, the Sanctuary, already on the brink of a grave ecological disaster will be lost forever and thousands of migratory avifauna will be deprived of their 'wintering ground'.

The latest piece of legislation which seeks to redress the situation is, The Tamil Nadu Aquaculture (Regulation) Act of 1995. It would be useful to examine the relevant Acts and legislation and then recommend suitable changes. This paper aims to provide a blue print for a legal reform.

75. CONSERVATION PERSPECTIVE OF CHILKA LAKE WITH SPECIAL REFERENCE TO ITS AVIFAUNA

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Chilka lake in Orissa is one of the major wetland on the east coast of the Indian Peninsula. It is one of the most important wintering grounds for migratory waterfowl. Considering the incredible congregation of waterfowls, both migratory and resident the lake has been designated as a wetland of International importance under the Ramsar convention.

150 species of birds have been reported from the lake area. This paper provides information on the migration pattern of some selected waders and waterfowl. It also recommends resource management based on sustainable development. The paper highlights disturbances and threats to the lake's ecosystem and emphasises improvement of habitat for migratory and resident ducks, especially in the context of recent developmental activities in and around the lake.

76. CONSERVATION OF BIODIVERSITY OF ANEKERE

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Anekere, area c. 25 acres, is a man made tank built in 1262 by the then ruler of Karkala, Pandyaadeva, of the Bhairavarasu dynasty. The tank is surrounded by lush vegetation consisting mainly of paddy fields and orchards of coconut and arecanut. This scenic pond was once a very productive ecosystem, which has now lost its past glory and is now a highly threatened wetland habitat of Karkala. The present project aims at the restoration of the original character of this vulnerable pond.

Conservation of the biodiversity of Anekere pond needs a long term strategy involving inventorying, monitoring and documenting the relative levels of biodiversity in relation to its water regime over a period of time.

The waterfowl inhabiting the Anekere pond studied since 1990 include interesting species like the Darter, Grey Heron, Night Heron, Little Green Heron, Little, Medium and Large Egrets,

White Stork, Whistling Duck, Cotton Teal, Common teal, Blue Winged Teal, Coot and the Bronze Winged Jacana.

POSTER

**77. WETLAND HABITAT CHARACTERISTICS OF KAWAR LAKE (BEGUSARAI)
BIHAR (INDIA): ITS SUSTAINABLE CONSERVATION FOR THE AVIFAUNA**

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Kawar lake, 25° 30'N, 87° 40'E, area c. 63.24 sq.km., located (c. 43.77 MSL) in Begusarai dt., North Bihar, is one of the identified and selected 21 lakes of India, under the National Lake Conservation Plan. It is an Ox-bow lake formed by the meandering action of the river Burhi Gandak, a tributary of river Ganga. This lake has vast biotic potential. 93 sp. of plankton, 47 sp. of macrophytes, 87 sp. of macro-invertebrates, 55 sp. of fishes and 186 sp. of avifauna, resident and migratory, have been recorded from this lake. Much of the open water stretches of the lake are now infested with macrophytes.

The lake is an important stopover point for passage migrants. It was recently declared as a bird sanctuary, by the Government of Bihar and steps are being taken for its sustainable conservation.

POSTER

**78. LIMNOLOGY OF CHIKLOD WETLAND - A HABITAT FOR MIGRATORY
BIRDS**

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Limnological studies were carried out on Chiklod wetland to assess its status and generate a baseline data for its conservation and management. Located in Chiklod village, about 50 kms from Bhopal, the lake, area c. 324 ha., is a private wetland. It is surrounded by agricultural fields and forests on one side. The lake served as a holiday resort for the then Nawab of Bhopal, during his hunting expeditions. It is now a source of water for irrigation and certain parts of the lake are also used for trapa culture.

The wetland is home to many local and migratory birds. Twentytwo species of birds have been recorded out of which six are migratory, these include, wigeons, pintails, gadwalls, moorhens, coots and pochards. Sixteen species of macrophytes which include, six submerged, seven emergent

and three free floating, have been recorded in the wetland, besides the wetland is also rich in macrobenthic fauna and fish.

Deforestation, increased human activities and agricultural runoffs loaded with silt, pesticides and fertilizers are a threat to the wetland and its avifauna. If proper steps are initiated, the wetland has a great potential as a bird sanctuary.

POSTER

79. CONSERVATION OF THE GREATER WETLAND SYSTEM OF DELHI - A MODEL ACTION PLAN

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The greater wetland system of Delhi owes its existence to the River Yamuna and the 45 Km. Najafgarh drain that pours into it. The Yamuna is dammed at the Okhla barrage in the south while an erstwhile ox-bow lake, at Bhalsawa exists in the North. The Sultanpur Bird Sanctuary in the south-west completes the system. Due to the continuous stretches of water and small distances of intervening land, waterfowl use the area as one wetland system.

This system is threatened by factors including habitat destruction, urbanisation, poaching and pollution. Najafgarh lake which was a 4.2 m deep waterbody of 22,700 ha in 1983 is now only a shallow part of the drain. Indicator species such as the Indian Skimmer *Rhynchops albicollis*, have virtually disappeared from the water stretches. Five years of waterfowl counts, 1989-93, during the Asian midwinter waterfowl census has given a clearer picture of species decline and substitution.

The system needs an action plan to conserve it in its entirety rather than in patches and segments. This paper presents the system as an integrated wetland with special reference to its waterfowl and proposes an action plan for its conservation.

POSTER

80. CONSERVATION OF NEW BREEDING GROUND OF FLAMINGOES AT SAMBHAR LAKE, INDIA

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Sambhar lake, area c. 190 sq. km, is the largest inland saline depression in India. A breeding site of the Greater Flamingoes *Phoenicopterus ruber*, was discovered for the first time at Sambhar Lake. The active breeding colony with numerous hatched eggs, consisted of more than 1000 mud nests. However, remnants of a breeding colony with thousands of nests was also found on the north

eastern side of Sambhar lake occupying an approximate area of one sq.km., towards Guda village. With the discovery of remnants and active breeding grounds of flamingoes at Sambhar lake, a Ramsar site, the wetland assumes significance and requires conservation measures.

Hundreds of private salt manufacturing units have sprung-up in recent years on the periphery of the lake. These units are regularly extracting huge amount of top soil, very close to the breeding sites, for constructing their salt manufacturing beds. Moreover, the construction of minor dams in the watershed zone of Sambhar lake for diverting rain water by small farmers is also hindering water supply to the lake.

Destruction of the lake's habitat and diversion of water are serious threats to the breeding grounds of the flamingoes. The lake and the surrounding area needs protection and should be declared as a wetland reserve or a Flamingo Breeding Sanctuary.

POSTER

81. BIRDLIFE IN THE MANGROVES OF QESHM ISLAND IN THE PERSIAN GULF

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NATURALIST/CONSERVATION ADVISER TO QFA

The Hara Mangroves serve as invaluable nesting areas for many species of Herons, Egrets, and Spoonbills. A pair of the rare Sacred Ibis was also observed recently in these mangroves. The Crab Plover is a conspicuous and important resident species, seen in flocks of hundreds, foraging on crabs on the mudflats. It has been recorded only occasionally elsewhere, the largest flock of 187 was reported on the Arabian islands near Kuwait.

Curlews, Redwattled Plover, Blackwinged stilt, Kentish Plover and the Broadbilled Sandpiper nest in the "khurs" (wadis) and the two damsites on the island, which have practically dried up in the last two drought years. Stone Larks (buntings), Ravens, Indian Rollers, Bee eaters, House Sparrows and several raptors, including the Egyptian Vulture, nest in the cliffs of the inner mountains.

The thick mangroves, of *Avicenna merina*, provide invaluable protected places for feeding and nesting to thousands of birds. These are the largest remnant mangroves, which covered a much larger portion of the coast in the past. Only small stands of these mangroves now remain on the south and northern shores around the Persian Gulf, while some relic forests of *Rhizophora mucronata* survive along the east coast. To replenish these remarkable forests, a million new plants of mangrove trees have been planted on the Qeshm Island, by the Free Area Authorities.

These pristine islands, some on ancient coral reefs, are excellent habitats for both resident and migratory birds and are noteworthy for the varied nesting species of terns and crab plovers. The warm and humid climate provides the westernmost, year around, habitat for many tropical species such as the purple sunbird, green bee-eater, wheatear, babblers, pond heron and flamingos. These are also observed on the largest island of QESHM, lying at the entrance of the Persian Gulf.

The richest ecosystem, occurs in the northwestern pocket in an archipelago of mangroves of QESHM, at the International Ramsar site of Khuran straits, harboring a varied birdlife of the region. Of the over 123 species recorded over 40-50 may be seen on a two-three day visit, such as the Great Flamingo, Dalmatian Pelican, Herons, Egrets, Curlews, the smaller but rarer Crab Plover, *Charadrius* sp., *Pluvialis* sp, Stints, Sandpipers and the rarely seen Stone Plover.

If this "seaforest" ecosystem would die or get degraded by pollution or over exploitation, there would be no comparable stopover point for migratory birds or a safe nesting area for the resident species.

POSTER

**82. CONSERVATION AND MANAGEMENT PROBLEMS OF KAWAR LAKE
WETLAND : THEIR SOLUTIONS**

VED PRAKASH AND U.P. SHARMA

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Kawar lake, 25°30' N & 87°40' E, area c. 63.24 sq. kms., located 22 km north west of Begusarai town in North Bihar, is an ox-bow lake. It is one of the 21 lakes identified for conservation and management by the Ministry of Environment and Forest, Government of India, under the National Lake Conservation Plan. Government of Bihar has declared this lake as a bird sanctuary. The lake has vast biotic potential and attracts resident and migratory birds. 93 sp. of Plankton, 47 sp. of Macrophytes, 87 sp. of macro-invertebrates, 55 sp. of fishes and 186 sp. of resident and migratory birds, have been identified from the lake. It faces degradation due to eutrophication, weed infestation, siltation and anthropogenic pressures. This paper discusses the solutions available for conservation and management of the lake on a sustainable basis.

POSTER

83. BIRDS AS INDICATORS OF COASTAL ECOSYSTEM CHARACTERISTICS

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The 500 km long coastline of Maharashtra State is characterised by a variety of ecosystems such as beach, mangrove, sea grass and coral ecosystems. It is known for its natural resources both in terms of flora and fauna. Various rivers originating from the western ghats as well as creeks along the coast have enriched the region with amazing diversity. Birds are also an integral part of coastal ecosystems.

Eleventh 'Pakshi-Mitra Sammelan' (Harihareshwar) marked the beginning of studies on coastal birds with respect to habitats. Prakash Gole surveyed coastal birds of Maharashtra in relation to their occurrence in a particular season. However, the changes brought about attempts to conceptualise methodology for using birds as indicators of coastal ecosystems, characteristics with respect to geographical locations as well as forest cover. This would help in preparing guidelines for coastal zone management with particular reference to the conservation of biological diversity.

POSTER

84. BIRDS OF MUMBAI MANGROVES I: A CHECKLIST

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Mangroves are life-sustaining, highly productive ecosystems. Their waters are nursery grounds for fish, crustaceans and molluscs and habitat for a wide range of aquatic life (Deshmukh 1990). They represent a much diverse structural habitat than any other ecosystem and harbour a greater variety of bird life (Cowkell, 1964; Field, 1968; Odum et. al., 1982; Samant, 1985).

Despite the various biotic and abiotic stresses, Mumbai's mangroves are capable of providing food and shelter for an amazing diversity of avifauna. During a study on bird assemblages of about 3000 acres mangrove forest area at Vikhroli (19° 06'N 72° 56'E), Mumbai, about 150 species of birds were recorded. Both resident and migratory in nature, they belonged to 16 orders, 39 families and 12 sub-families. This diversity of bird life appears to be quite significant as compared to the different mangrove ecosystems around the world, such as Gambia (45), Surinam (87), Sierra Leone (76), Malaysia (121) and Florida (181).

This paper highlights the percentage composition as well as relationships between foraging behaviour and assemblages of birds visiting mangrove forests of Mumbai.

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POSTER

85. THE RELATIONSHIP OF THE AVIFAUNAL DIVERSITY AND BIOTIC THREATS IN DEEPAR BEEL WILDLIFE SANCTUARY OF ASSAM : AN ANALYSIS

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The conservation of diversity in waterbirds has attained global importance as it is a reflection of habitat richness at the community level. Longterm monitoring of this heterogeneity and the biotic pressure on it enhance conservation measures. In Deepar Beel wildlife sanctuary, an internationally important wetland of Assam, known for its avifaunal diversity, a five year study was undertaken for monitoring the wintering bird diversity and the probable impact of the various biotic factors. A scaling approach was adopted for weighting the biotic threats in relation to the wetland avifaunal community. Altogether seven biotic threats were identified and were correlated with the fluctuation of the diversity of avifauna and the species richness for both wintering and resident species. The variations of the species diversity in these years were between the value range of 2.8 to 4.1. The

equitability (E) shows a decreasing trend mainly due to non-utilization of the wetland by some rare birds of this region, thus affecting the crucial ornithological value of the sanctuary. This paper recommends protection measures for the management of the avifauna of the beel as well its biodiversity.

POSTER

86. WETLANDS OF KANHA TIGER RESERVE POTENTIAL SITE OF INTERNATIONAL IMPORTANCE

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Wetlands of the Kanha Tiger Reserve have not been adequately studied. In the management plan of the reserve it is stated that "True wetlands do not occur in Kanha National Park in terms of theoretical definition". Little emphasis has been accorded to the study of wetland ecosystems in the reserve. This paper attempts identification, classification and evaluation of wetlands in the Kanha Tiger Reserve.

The reserve lies in the biogeographic province of the Indus-Ganges monsoon forest in the Indomalayan realm. Springs, rivers, streams, freshwater ponds, marshes, swamps, rice paddies and irrigated lands are the types of wetlands found in the reserve. Hardground Swampdeer, Smooth Indian Otter, Tiger, Lesser Adjutant, Ferruginous Duck, Indian Rock Python, Common Indian Monitor Lizard are some of the threatened species found in the reserve's wetlands. Timely conservation measures have saved the hardground Swampdeer from extinction. It is a unique representative of the typical wetlands of the region. 47 species of waterbirds are found here. To assess the number of aquatic birds midwinter waterfowl census is recommended.

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CONSERVATION OF WETLANDS

**87. HEALTH CONSIDERATIONS IN THE CONSERVATION OF GRASSLAND
AND WETLAND BIRDS**

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Grassland and wetland birds are probably most at risk from habitat deterioration but other factors may become more important as populations diminish or are put under pressure. Amongst these factors are pathogenic organisms, including parasites and toxic chemicals.

There are few data on the health and diseases of most avian species and grassland and wetland birds have received particularly little attention in contrast to those that inhabit islands or forests. Health monitoring should be a routine part of field research and involve biologists as well as veterinarians.

88. DRY GRASSLANDS AND AVIAN DIVERSITY; A GLOBAL PERSPECTIVE

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Grasslands and grass-based habitats remain underrepresented on the global conservation agenda. Their contribution to the sum of biological diversity is not, however, insignificant, while their degradation and destruction is rapid. The avian diversity (in higher taxonomic terms) embraced by grass-based habitats is extensive. The distribution of the smaller centres of avian endemism within grassland biomes is plotted, using species with ranges of less than 50,000 sq. km. The distribution of globally threatened species is also plotted, based on data assembled by Birdlife International. From these two datasets, priority areas for the conservation of avian diversity in grasslands can be identified. With the additional use of near-threatened species, the key countries for grassland conservation are tabulated. The plight of the grasslands and their associated birds in south-eastern South America (Brazil, Paraguay, Argentina) is very serious. Grassland birds react in various ways to human impacts on their environments and the appropriate management of a grass-based landscape will depend on the particular species needing attention. The major negative impact is, however, the intensification of agriculture, so the major palliative must be its "extensification" (i.e. the adoption of appropriate non-intensive management regimes). In most regions baseline data is urgently needed to establish monitoring programmes.

89. STEPPE BIRDS AND AGRICULTURE IN SOUTHERN EUROPEAN RUSSIA

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In Russia about 10 per cent of the total land area is cultivated while within the Steppe zone in southern European Russia over 60 per cent of land is under agriculture. However, not all environmental changes caused by agricultural development are completely detrimental for avifauna. New elements like irrigation ponds and plantation of forest strips and spots certainly enrich steppe environment and bird diversity. For example within the Lower Don river basin bird diversity consists of 213 nesting species of which only 26 species belong to indigenous steppe and meadow habitats while 86 species inhabit such introduced habitats as small forest fragments (5 per cent of the total area). At the beginning of intensive steppe cultivation hundred years ago, majority of indigenous birds either survived within isolated spots of virgin steppe habitats, mostly small species like larks or left the area, mostly large species like bustards, steppe eagles, etc. However, recent evidence suggests that steppe birds adapting to agricultural habitats have shown a slight increase in their populations.

90. SPREAD OF SCRUB IN GRASSLANDS, AND ITS IMPACTS ON THE AVIFAUNA

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The study was carried out at the Rollapadu Wildlife Sanctuary (15° 52'N & 78° 18'E), located in Kurnool district, Andhra Pradesh, between 1992 - 1995. The scrub vegetation in two habitat types i.e., grassland (protected) and grazing lands (unprotected), were quantified and the bird species composition and abundances in both were censused for two years.

The results show that there has been an increase in scrub vegetation in the grassland due to protection. This has resulted in a loss of habitat for grassland avifauna such as the Great Indian Bustard *Ardeotis nigriceps*, Lesser Florican *Sypheotides indica*, sandgrouse, pipits and larks. Conversely there has been an increase in scrubland birds such as doves, babblers, bulbuls, warblers and munias. The trend is the reverse in grazing lands. Scrub cover and avifauna of scrublands have decreased due to tree cutting and browsing by livestock. This has caused an increase in 'grassland' cover and avifauna that thrive in overgrazed conditions.

It is recommended that the spread of scrub be checked in the protected plots of the Sanctuary.

In addition, the present scrub cover along the streams of the plots should be thinned to about 50 - 75 % of its present levels. This step would open up more areas for the Great Indian Bustard (and other grassland fauna) for which the Sanctuary was created.

91. AVIFAUNA OF TRANS-HIMALAYAN AND ALPINE GRASSLANDS IN SIKKIM, INDIA

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Surveys in the trans-Himalayan and alpine regions of Sikkim have been carried out from 1988 to 1994 under the Asian Waterfowl Count, in seasons suitable to Sikkim. 50 species of water birds were listed as against 30 reported/unconfirmed by Ali (1962). A recent survey documented 56 species of grassland and forest birds, including species such as Blacknecked Crane *Grus nigricollis* and Kessler's Thrush *Turdus kessleri*. Some of these are new records for Sikkim. The paper discusses the importance of these records and compares them with species reported during an earlier survey in 1955-57, Ali (op. cit.)

As most of these species are trans-border migrants and endangered or threatened, the development of a trans-border protected area particularly on the Chho Lharno plateau as an International Peace Park is proposed.

92. GRASSLAND ECOSYSTEMS: STATUS & FUTURE STRATEGY FOR BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT IN DROUGHT PRONE AREAS OF GUJARAT

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The livelihood pattern of the people of any region is conditioned by the stages of economic development and the extent to which the available natural resources are utilised. The wise use of resources provided by grasslands and the sustainable development and conservation of biodiversity of these ecosystems forms the crux of the present management and development strategies of the Forest Department in Gujarat State. The department is involved in the management, development and conservation of grasslands, having an area of c. 1,402 sq. kms. These grasslands are also known as Vidis in Saurashtra and Panchmahals, whereas in Kachchh these are known as Rakhals. On an average the department collects 16 million kgs. of grass annually and is in a position to supply about 40 million kgs. of grass at any point of time. Estimated livestock population of Gujarat state is about 22 million, whereas, total forest area is c. 19,393 sq.km. which constitutes c. 9.8% of the total land area of the state. Most of the areas of Gujarat are drought prone where cattle rearing is one of the major occupations.

In spite of continuous exploitation of these grasslands due to expanding economic activities, the overall range of biodiversity of these areas is still remarkable. The economic demands are giving rise to conflicts which require new perspectives involving social, economic and environmental concerns, with an approach to habitat protection and biodiversity conservation.

Two essential points must be incorporated in grassland management strategies, especially in drought prone areas, i.e. inconsistencies in agency regulations within an ecosystem must be overcome and second understanding and integrating human activities into environmental systems to ensure people's participation in long-term efforts for conserving the precious biodiversity of grassland ecosystems.

93. CONSERVATION OF HIMALAYAN MONAL IN ALPINE PASTURES OF KEDARNATH SANCTUARY IN GARHWAL HIMALAYA

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Distribution and habitat preference of the Monal *Lophophorus impejanus*, was studied in Kedarnath Sanctuary, Garhwal Himalaya (30° 25' - 30° 45' N, & 78° 55'-79° 22'E).

Monal feed on root tubers and grass seeds in subalpine and alpine pastures, from March to October. They also use these grasslands for breeding. Observations indicate that Monal spend $39.70 \pm 4.51\%$ time/day during breeding period in grasslands. Relative abundance of Monal in the area was 2.47 ± 0.20 individuals/sighting.

During summer "Gaddi's" and "Gujjars" in the region move from lower altitudes with their livestock to these alpine pastures. These grasslands are unable to fulfill the fodder demands of the animals, resulting in an ecological imbalance in plant animal relationship. This ultimately affects the breeding and feeding habitats of the endangered monal pheasant and other endangered galliformes viz. Snow cock, Chukor and Snow partridge. Heavy bovine pressure on the grasslands of the alpine region could, therefore, be one of the reasons for endangerment of these galliformes. In-depth studies on habitat use, nutrient cycling etc. are being conducted for the management of alpine grasslands. Rotational and limited grazing in the pastures must constitute an important component in the management plan of the grasslands. A recent threat to galliformes inhabiting these grasslands is the development of a skiing resort by Garhwal Mandal Vikas Nigam, U.P. in Chopta (adjacent to Kedarnath Sanctuary). This needs to be immediately checked considering that the area constitutes the winter habitat of the pheasants.

94. HABITAT PREFERENCE AND POPULATION DYNAMICS OF INDIAN FRANCOLIN AND QUAIL: IMPLICATIONS FOR CONSERVATION

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Effective conservation strategies aimed at the species or family level can only be achieved through an understanding of the interaction between ecological requirements and population dynamics. This paper examines habitat preferences and basic life history strategies of sixteen peninsular Indian francolin and quail species. Specific aspects of galliform species ecology that need to be addressed under prevailing field conditions in India are identified. Suggestions are made for the development of adequate conservation strategies that integrate studies of species ecology with habitat management.

95. THE CURRENT STATUS OF SOUTH ASIAN OPEN COUNTRY PARTRIDGES- AND PHEASANTS AND THEIR CONSERVATION RESEARCH NEEDS

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The World Pheasant Association has recently overseen the production of Global Action Plans for Partridges, Quails, Francolin, Snowcocks, Guineafowl and Pheasants. Compiled by Specialist Groups of the Species Survival Commission of IUCN. They are the result of extensive consultation and review within worldwide networks of biologists. Threat categories were assigned to species and some subspecies and based on these threat perceptions, priorities for action were identified. Within South Asian Grasslands, the Swamp Francolin *Francolinus gularis*, the Manipur bush quail *Perdica manipurensis*, the Indian mountain quail *Ophrysia superciliosa* and the cheer pheasant *Catreus wallichii*, emerged as priorities. Projects that should be initiated on behalf of these species within the period 1995-1999 are mentioned. Finally, two longer-term research needs are discussed. There is a need to understand the importance to phasianid species of grasslands within the mosaic of habitats used and the urgent requirement to initiate population monitoring for common grassland species at particular sites.

96. CHANGING AVIFAUNA OF THE THAR DESERT DUE TO THE IGNP

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97. CONSERVATION OF TRANS-HIMALAYAN GRASSLANDS AND WETLANDS

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The grasslands of Ladakh are under tremendous livestock grazing pressure especially in the Changthang area. The livestock of Leh Valley enters Hemis National Park, similarly more than four to five lac sheep and goats of migratory Bakerwals from Shiwaliks enter Drass and Rangdum (Zaskar) grasslands every year. These inroads into the habitat of wild herbivores, like the Wild Ass, have reduced their foraging areas considerably. Similarly opening of Changthang and Karakoram areas to tourists is a threat to their habitats, thus endangering their very existence.

Since the grasslands and wetlands of Trans-Himalaya are the last treasure of vanishing wildlife on this planet, it needs to be conserved and saved from the increasing population of livestock and opening of these areas to tourism will further disturb the breeding population of Blacknecked cranes in the area.